FLIGHT

The AIRCRAFT ENGINEER & AIRSHIPS

First Aero Weekly in the World

Founder and Editor: STANLEY SPOONER

A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport

OFFICIAL ORGAN OF THE ROYAL AERO CLUB OF THE UNITED KINGDOM

No. 610 (No. 36, Vol. XII.) SEPTEMBER 2, 1920 [Weekly, Price 6d. Post free, 7d.

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The Aircraft Engineer and Airships

Editorial Offices: 36, GREAT QUEEN STREET, KINGSWAY, W.C. 2

Telegrams: Truditur, Westcent, London. Telephone: Gerrard 1828

Annual Subscription Rates, Post Free:
United Kingdom .. 30s. 4*d*. Abroad.. .. .. 33s. 0*d*.*

These rates are subject to any alteration found necessary under abnormal conditions and to increases in postage rates

* *European subscriptions must be remitted in British currency*

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Sept.	**International aviation week (with competitions) at Brescia, Italy**
Sept. 8, 9 and 10	**Fédération Aéronautique Internationale Conference, Geneva**
Sept. 18–19	**Schneider International Race, Venice**
Sept. 27 to Oct. 2	**Gordon-Bennett Aviation Cup, France**
Oct. 1, 2, 3.	**A.C.F. Meeting at Buc**
Oct. 7	**Lecture on "Civil Aviation," by Sir F. H. Sykes**
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Nov. 1	**First Open Competition for R.A.F. Boy Mechanics**

EDITORIAL COMMENT

WITH amazing effrontery the great petrol-selling companies have suddenly sprung on the community an unexampled increase in the cost of petrol. Aviation spirit has been increased by no less than eightpence per gallon. Even at that it gets off comparatively lightly, since "No. 1" spirit has been advanced by the unparalleled amount of elevenpence a gallon. That is to say, the latter spirit now costs 4*s*. 7½*d*. a gallon, and aviation petrol 4*s*. 9½*d*. per gallon. The very thin excuse given for these simply appalling increases is the rise in railway and freight rates. This entirely fails to carry conviction to the ordinary person, who is scarcely to be blamed if he regards the affair as another example of the uncontrolled rapacity of the oil trusts. It is another object-lesson in the fact that the price of petrol is "what it will fetch."

The Great Petrol Ramp

When the Finance Bill was before Parliament recently and the clauses relating to the new motor taxes were being debated, not the least telling argument employed by the Minister of Transport was to the effect that he had received an assurance that when the new taxes became operative the petrol companies would take 7*d*. per gallon off the price of fuel. The cool audacity of the thing is demonstrated by the fact that in the case of second-grade spirit—which will be the more largely used—the increase is precisely 7*d*. per gallon. That exact amount has been put on four months in advance, to be taken off —perhaps—in January next! Unfortunately, we are completely in the hands of the monopolists, and whether we like it or not we shall have to pay what they ask or do without. It is that which irks even more than the actual imposition.

What the effect will be on the development of commercial flying it is too soon to speculate. It must in the very nature of things be very adverse. Coming, as it does, just when flying was beginning to make headway and to obtain recognition as a means of transport, the wicked rise in the price of essential fuel is a blow which will need all the courage and all

the enterprise of those who stand at the back of development to face. An immediate increase of 17 per cent. in the cost of fuel, with in all probability more to follow, must make people think very hard. Nor is it as though the 17 per cent. were to be added to a moderate initial price. Before the increase came into effect on Monday last, petrol stood at roughly three times its pre-War cost, and that was itself well-nigh ruinous to industries dependent, as aviation is, on adequate supplies of fuel at a moderate price. It is perfectly certain that no transport, whether by road or air, can develop under such crushing burdens as the Government and the petrol trusts between them are striving to impose. For a long time past we have viewed with the gravest concern the indications pointing to the future upward tendency in fuel prices, because we realise how vital to the nation and its industries it is that cheap transport should be developed as rapidly as possible, but we confess we had not thought the effrontery of the trusts would have carried them to the lengths they have now gone. The question that is uppermost now is: Where is all this going to end? End it must, in some way or other, for matters are rapidly approaching the breaking point. The community cannot go on paying all these extortions for ever. Sooner or later it will move—and it will be bad for the extortioners.

Good Propaganda

Some months ago, when writing on the need for propaganda work in connection with the development of commercial aviation, we said we could wish it were possible to give demonstration flights to representatives of every newspaper in the country. Obviously, this was a counsel of perfection and not practically possible as things are today. In the years to come it will be unnecessary, because every newspaper of any importance at all will have its own aerial service of some kind, and the need for missionary work will have disappeared. We are more than glad to know, in this connection, that Messrs. Handley Page are doing something towards making the safety and certainty of aerial transport known to the public through the medium of the Press. They have arranged a series of flights for the—may we say?—education of the lay Press in the real possibilities of flight as a method of transport, and we foresee that infinite good to the movement is likely to result as a consequence.

Flight has become very familiar in the abstract to the general public, but it has not yet reached the concrete and established stage in the lives of the community which has been arrived at by older methods of transport. This may seem to be a truism, but it nevertheless requires stating in order that we may, so to say, get a starting-point for our propaganda. In the early days of the railway, the same sort of propaganda was necessary. Prominent public men and the editors of the newspapers of the day were given "joy-rides" on the new iron way in order that they should be made into missionaries of the new transport. From that to inducing the public as a whole to take advantage of the facilities of the railway was a long task, but the essential start was made, and the rest was only a matter of time. It was the same in the youth of the motor-car. We are most of us old enough to recollect the amount of missionary propaganda that had to be carried out before the motor-vehicle became a part of the every-day life of the people. We can remember the prejudice that had to be lived down before the public would even look upon it with anything approaching toleration. Yet its use today, less than a quarter of a century after its use on the highways was legalised, is universal. So in the case of aircraft, except that the latter are in a more favourable position than the car was twenty-four years ago, inasmuch as there is no prejudice against the aeroplane or the airship as such. People do not in the mass realise that they are really safe and certain mediums of transport, and it is in this direction that the main work of propaganda has to be carried on. No better way of indoctrinating the public with the necessary faith can be devised than that which is now being worked by Messrs. Handley Page, and we commend the example to all others who are actively interested in the rapid development of commercial aviation.

R.N.A.S. and R.N.A.C.D. Memorial Fund

It is proposed to inaugurate a fund to perpetuate the memory of the officers and men of the Royal Naval Air Service and the Royal Naval Armoured Car Division who fell in the War. The memorial will, it is proposed, take the form of a row of cottages, with an inscribed tablet, on the Enham Village Centre estate for disabled ex-Service men at Andover. These two auxiliaries of the Navy ceased to exist as separate units before the end of the War, but it is thought that those who served in them will welcome the opportunity of perpetuating the memory of their comrades who fell in every theatre of War during the great world struggle.

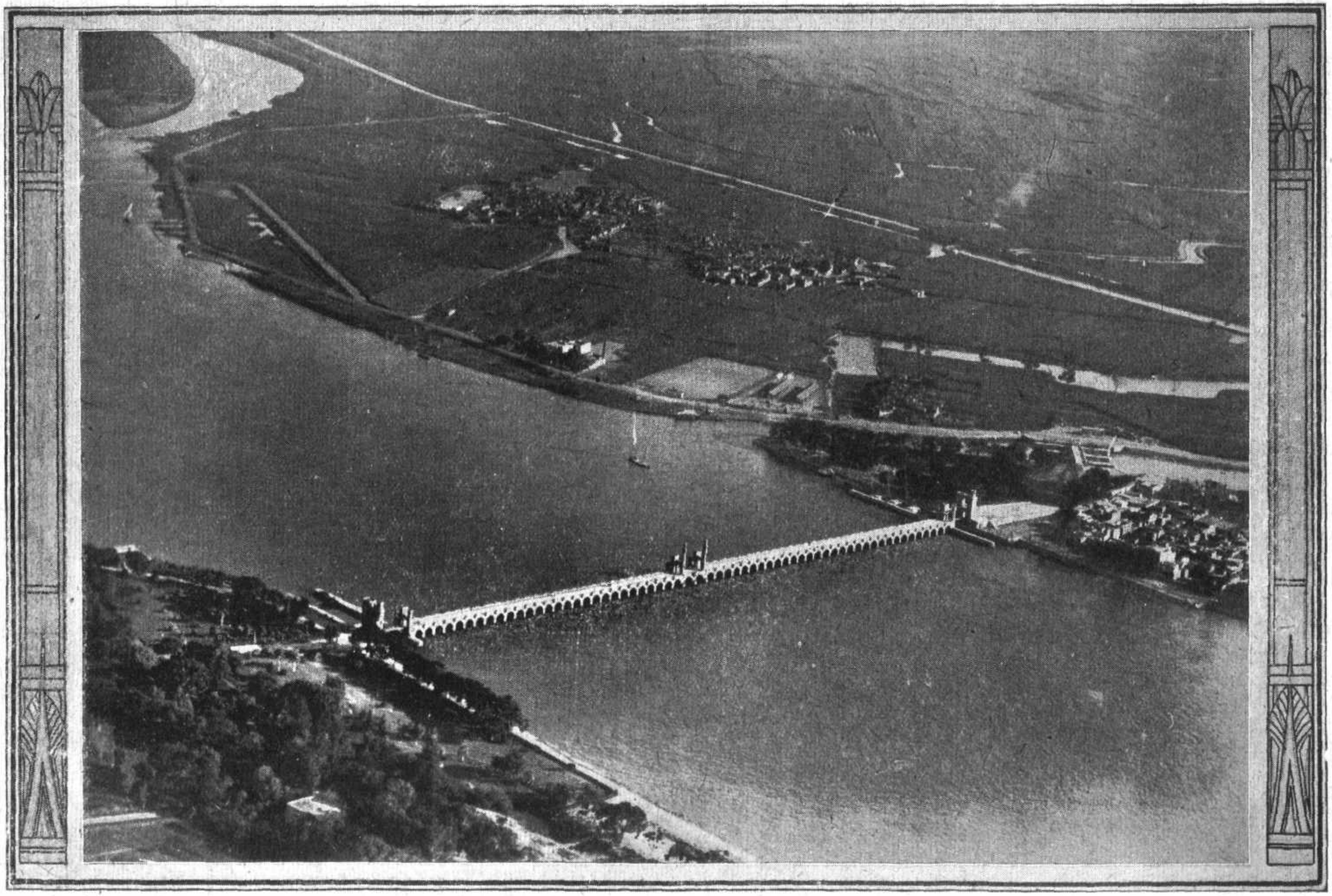
The idea is excellent, and will, we are certain, meet a ready response from those who served in these two forces. Moreover, it seems to us that the manner in which it is proposed to apply such fund as may accrue through Admiral Sueter's appeals is altogether admirable. We have enough of cenotaphs and memorial columns scattered all over the country, and we are utilitarian enough to think that the memory of the gallant dead can be best perpetuated by doing what is possible for those of their old comrades who are no longer able to fend for themselves. We like the village centre idea, and are convinced that such a memorial as this will appeal far more to the officers and men of the two units than would the proposal to erect a memorial tablet in St. Paul's. Subscriptions should be sent to Sir Fredk. Milner or to Mr. G. Bromley Martin, Village Centres Council, 10, Upper Woburn Place, W.C. 1.

Lloyd's Registry for Aviation

As will be gathered from a *communiqué* which is printed in another part of this issue of FLIGHT, the Committee of Lloyd's has approved the establishment of a Lloyd's Aviation Record, the first part of which will shortly be issued to subscribers. The *communiqué* sets forth that the policy the Committee have in view is to create facilities whereby constructors of aircraft, air transport companies, and underwriters of aviation risks may equally benefit, while the Record should tend also to assist in the development of civil aviation.

What this really means is the establishment of a record similar to Lloyd's Registry of Shipping. It will, of course, be a very long time before the

The Camera and the 'Plane



THE NILE: The Barrage Dam, as seen from an aeroplane

Aviation Record attains quite to the dignity of the former, but everything has a beginning. Apart from the enormous use such a Record must be to everyone concerned in any way with the development of aerial transport, we see in the fact that the Committee of Lloyd's has thought it essential to establish the Record a most significant sign of the times. Lloyd's is a very old, and withal a very conservative institution, which does not leave the beaten track save for good reason shown. The fact, then, that the Committee has done what it has shows how very seriously people are regarding the possibilities of the new transport. Further, the Committee is so deeply in earnest that it makes no secret of the fact that in its judgment the Record will have to be of international scope, and steps are already being taken to establish Lloyd's aviation agents and surveyors at home and abroad.

There can be very little question about the future of civil aviation when these things are. It is no longer a matter of speculation whether or not flying will manage to survive and take its place as a mode of transport. It has already done the latter, and as to survival we have no manner of doubt at all. Development may be slow, relatively speaking, but every indication points straight to the outstanding fact that aviation is here as an established factor in the world's communications, while those who are best qualified to judge are laying their plans for dealing with it on a scale which is hardly appreciated as yet.

International Air Races

According to official information, the Racing Committee of the Royal Aero Club has selected its team for the representation of Great Britain in the race for the Gordon-Bennett Cup, which is to be held at Etampes on the 28th inst. Needless to say, the team is a good one. It could not under present circumstances be bettered, though a little anxiety is to be expressed regarding the selection of Mr. Tait-Cox, who is given as flying a Nieuport "Goshawk," in view of the present position of the Nieuport business. It would be somewhat reassuring to receive a definite statement that he will start or, alternatively, the name of the pilot and machine who will take the vacant place, assuming there to be any hitch. The selection of Messrs. Hawker and Raynham was well-nigh inevitable, and it may be assured that the honour of Great Britain will be safe in their hands.

Unfortunately, we are informed that up to the present no British entries have been received for the Jacques Schneider international seaplane race, which is to be held at Venice on the 19th inst. This is a matter of extreme regret, since it is well-nigh vital that this country, which took the lead so easily in the design and construction of the seaplane and the flying boat during the War, should be represented. Further, it is absolutely beyond words that there is more than a probability that Great Britain, the first maritime Power of the world, should be unrepresented in a race for marine craft. What is the matter with our seaplane and flying boat constructors? Have they got "cold feet," or are they suffering from a sense of injury on account of the unfortunate *contretemps* which disfigured the last race for the Cup? It cannot be the first, and we dislike the thought that it may be the last. Surely they are too good sportsmen to allow bygones to weigh in the balance against the honour of the country and the industry. For all and every reason we sincerely hope that before the closing date arrives there will be sufficient British entries to give us a chance of again bringing the Cup back to these shores.

LLOYD'S AVIATION RECORD

AN official statement has been issued by Lloyd's as follows :—

The Committee of Lloyd's, recognising the growing importance of aviation insurance, established some time ago a Sub-Committee on Aviation assisted by a Technical Committee. The membership of the committees include representatives of the air transport companies, aircraft constructors and underwriters.

It is clear, on the one hand, that enterprise in connection with civil aviation would be greatly assisted by adequate insurance facilities; on the other hand, these facilities cannot be provided unless certain essential information is collected and recorded in an available form. The establishment of a Lloyd's Aviation Record has therefore been approved.

The first part of the Record will be shortly issued to subscribers, bearing information in respect to aircraft and pilots, and it is intended to follow this with further information as to technical personnel, aerodromes, alighting waters, air routes, foreign laws, etc.

The scope of the Record will be international, and steps are being taken to establish Lloyd's aviation agents and surveyors at home and abroad.

While those desirous of securing information afforded by the Record will be required to subscribe to its maintenance, it is not the intention to make it more than self-supporting.

It is the policy of the Committee in establishing Lloyd's Aviation Record, to create facilities whereby constructors of aircraft, air transport companies and underwriters of aviation risks may equally benefit, and furthermore, it is thought that the benefits arising should tend to assist in the development of civil aviation.

Every effort will continue to be made to secure in the committees responsible for the maintenance of the Record, an adequate representation of the various aeronautical interests involved.

Pilots desirous of being enrolled on Lloyd's Aviation Record may apply for a form of application to the Secretary, Lloyd's, Royal Exchange, London, E.C. 3. Similarly, owners of aircraft who may wish to ensure correct information as to their aircraft now being placed upon the Record, may procure the necessary form from the same source. Upon return of the form properly completed, the information contained therein will be recorded free of charge.

Lloyd's Aviation Sub-Committee

The Chairman, Sidney A. Boulton, Esq.

E. E. St. Quintin, Esq., Committee of Lloyd's.

P. G. Mackinnon, Esq., Committee of Lloyd's.

A. L. Sturge, Esq., Committee of Lloyd's.

H. Barber, Esq., Aviation Insurance Association, 1, Royal Exchange Avenue, E.C. 3.

Lt.-Col. C. E. C. Rabagliati, White Cross Aviation Insurance Association, 5, Moorgate Street, E.C. 2.

A. Newman, Esq., Union Insurance Society of Canton, Ltd., 2, White Lion Court, E.C. 3.

Lt.-Col. W. A. Bristow, Messrs. Ogilvie & Partners, Ltd., 104, High Holborn, W.C. 1, Consulting Engineers to Lloyd's Aviation Record.

Capt. P. D. Acland, Aviation Dept., Messrs. Vickers, Ltd., Vickers House, Broadway, S.W. 1; C. V. Allen, Esq., Secretary of British Aircraft Constructors, 1, Albemarle Street, W. 1; representing Society of British Aircraft Constructors.

Major-General Sir W. S. Brancker, K.C.B., Chairman of Aerial Transport Section, S.B.A.C.

Admiral Sir Edward F. Inglefield, K.B.E., Secretary of Lloyd's.

Capt. H. R. Gillman, Secretary, Lloyd's Aviation Record.

THE AIR MINISTRY SEAPLANE (AMPHIBIAN) COMPETITION

Only Five Machines Entered

WEDNESDAY of this week was the opening day of the competition for amphibious seaplanes for prizes offered by the Air Ministry. In view of the importance to the Empire of developing the seaplane—and by this we mean the float as well as the boat type—the entry of five machines only for this part of the Air Ministry Competitions is not a little disappointing. Widely scattered as this Empire is, communication between its different parts must of necessity take place by or over sea. It would therefore appear obvious that the type of aircraft which is capable of operating over the sea will be the one chosen when mails and other urgent matter are transported, regularly and as a matter of course, by way of the air. Nor is it only for air services in the colonies and dominions that the seaplane will prove its utility. Take the case of a service much nearer home, and one already being run by land machines. Before the traveller by air can go from London to Paris he has to motor out to Croydon. He there boards the aeroplane and proceeds to le Bourget. Having arrived there he has before him another motor ride before he finally arrives in Paris. In the case of passengers the delay caused by this transfer is very considerable, and occupies a time quite disproportionate to that occupied by the actual air journey. When it comes to mails and goods the delay is even more marked.

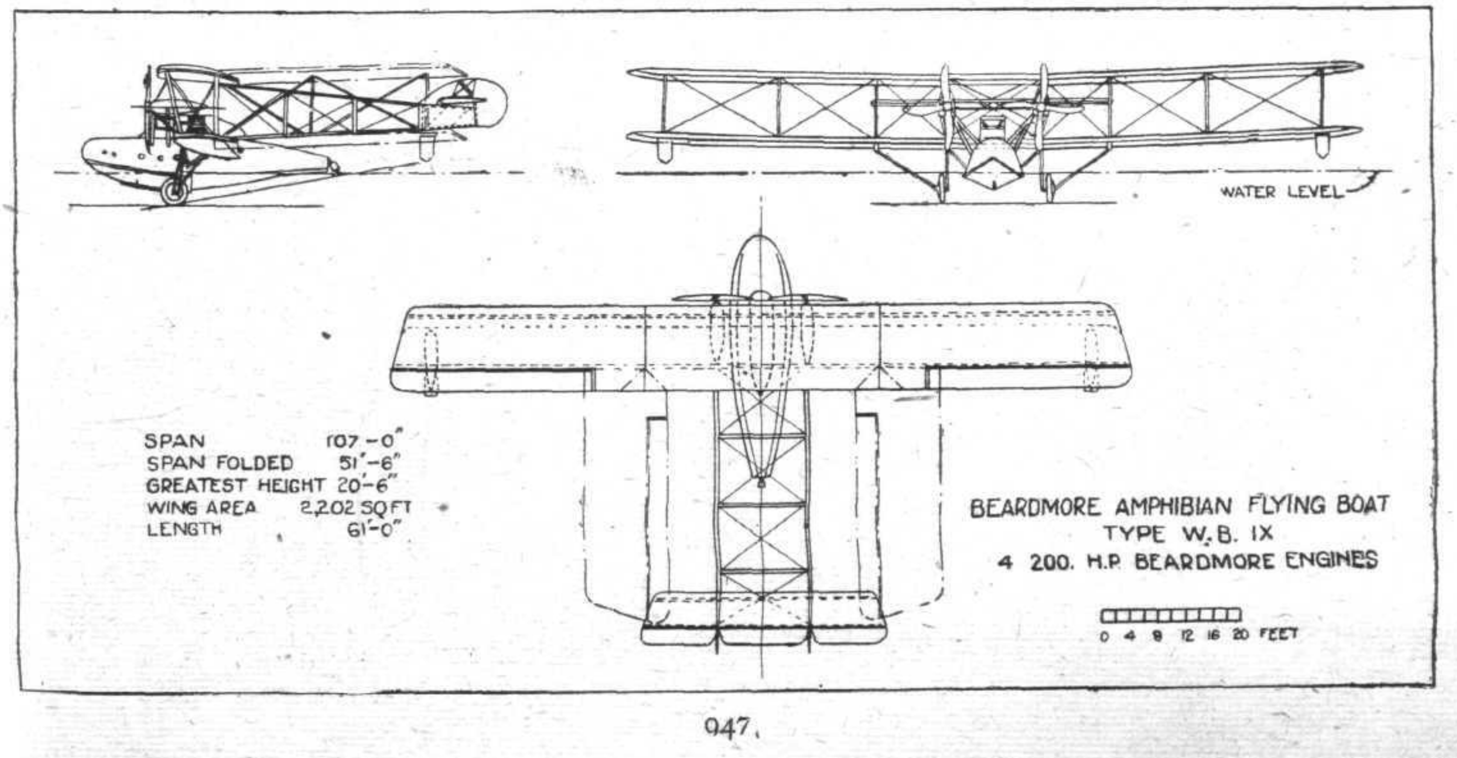
If this service could be operated by means of flying boats or seaplanes, which could start from the Thames in the centre of London and alight on the Seine in the middle of Paris, a great amount of time would be saved. The manœuvrability of modern seaplanes is such that we have not the slightest doubt that starting from and alighting on rivers as wide as are the Thames and the Seine could be effected without danger to other craft. Such a service, if carried out by the ordinary seaplane or flying boat, would, however, necessitate a re-laying of the route, to follow the river down to the sea and then follow the coast until the other river was reached, when the machine would follow this to its destination. This would mean a waste of time compared with the machine capable of following the direct route. To effect a saving in time by taking the latter route would only be feasible if the machine were capable of making, if necessary, a forced landing *en route*, and this brings us to the question of the amphibian machine, which is precisely the type that the latter part of the A.M. competitions is designed to try out.

It must be admitted that conditions are not undisputedly in favour of the amphibian seaplane, or even of the ordinary seaplane. For instance, the weight of a flying boat or of a float seaplane is, generally speaking, greater than that of a land machine of the same size. This means that the seaplane type is likely to be able to carry a smaller useful load than the land machine of the same power. Where, therefore, conditions permit, the land machine is likely to be employed in preference to the seaplane. Also, the addition of a land undercarriage with its operating gear adds still more weight to the seaplane, thus further reducing its capacity for carrying paying load. It is, however, easy to imagine conditions which would render the amphibian seaplane preferable to the land machine in spite of these fundamental handicaps, and consequently the production of a seaplane in which the structural weight is reduced as much as possible, combined with the necessary factor of safety and other desirable features, is a problem of no small importance. If aero engines were absolutely reliable—that is to say, if they could be guaranteed never to break down while the machine was *en route* for its destination—the question would not arise, as there would then be little or no use for any sort of flotation gear. This desirable state of affairs is not reached, however, nor is it likely to be for many years to come, and in the meantime the possibility of engine breakdown has to be considered. It is quite possible that the time will come when the tendency is all towards specialisation: fast machines will be used for one purpose, slow machines for another; seaplanes will carry the passengers and cargo over sea, and on arriving the other side they will be transferred to a land machine. Before this comes about, however, a great amount of organisation, much of which will have to be of an international character, will have to be done, and in the meantime we cannot afford to neglect the development of one type at the expense of the other. We especially in this country, even when and if such specialisation comes about, shall probably be carrying much of the world's seaplane-borne traffic, and hence should neglect no effort which will help to place us in the lead where the construction of seaplanes is concerned.

With regard to the amphibian type of seaplane, we think that the land undercarriage should be looked upon as an accessory to be used in emergency only, rather than expect an amphibian machine to be capable of landing habitually on land. It is quite obvious that the shocks of alighting on an aerodrome are apt to strain the boat hull locally more than do the distributed shocks encountered when a boat or a pair of floats meet the surface of the sea. Unless, therefore, the retractable land chassis and its attachments to the floats or boat are disproportionately heavy, repeated alightings on land will be apt to strain the hull or floats, and for the sake of economy the weight will have, as already pointed out, to be kept down as much as possible. The amphibian machine must of necessity be a compromise, and to expect it to be *equally* suitable for land and sea is somewhat unreasonable. Nor is this probably in the minds of those who have drafted the rules for this part of the competition.

THE MACHINES

As already mentioned, the list of entrants for the competition is somewhat disappointing, being confined to five firms as follows: William Beardmore and Co., Ltd., Fairey Aviation Co., Ltd., S. E. Saunders, Ltd., Supermarine Aviation Works, Ltd., and Vickers, Ltd. Out of the five machines entered, four are believed to be flying boats, while



the fifth, the Fairey, will probably be a float seaplane. We have, however, been unable to obtain any particulars of several of the machines, and so nothing definite can be stated on this point.

The Beardmore W. B. IX

Quite extraordinary interest attaches to the machine entered by Wm. Beardmore and Co., on account of its unusual construction no less than because of its central engine arrangement with transmission drive to airscrews on the wings. The general arrangement of the machine will be understood by a reference to the accompanying scale drawing. The W. B. IX, it will be seen, is a flying boat of the "Bat-boat" type. That is to say, its main hull is relatively short and does not carry the tail, which is supported on a separate structure of the open girder type. The main planes have a span of 107 ft., and the lower plane is of considerably smaller chord than the upper. The total wing area is 2,202 sq. ft., so that the machine is far from being a "Tabloid." The overall length is 61 ft., and the height is 20 ft. 6 ins. The wings, which have a straight centre section to which the end sections are set at a dihedral angle, are designed to fold, when the overall span is reduced to 51 ft. 6 ins. The size of hangar necessary for housing the machine is thus reduced to about 53 ft. wide by 62 ft. long by 23 ft. high. The weight of the machine empty is 9,520 lbs. and fully loaded 14,000 lbs., giving a wing loading of 6.35 lbs. per sq. ft. The power of the four Beardmore engines is 800 h.p., giving a power loading of 19.4 lbs. per h.p. The load carried is composed as follows :

Passengers—10 at 160 lbs.	1,600 lbs.
Luggage—20 lbs. per passenger ..	200 ,,
Pilot	180 ,,
Engineer	180 ,,
Petrol	1,900 ,,
Oil	220 ,,
Water	200 ,,
Total ..	4,480 lbs.

As the machine has not yet been tested, actual performance figures are not available, but the following estimated performance data are of interest :—

Max. speed at ground level, 93 m.p.h. At 10,000 ft., 82 m.p.h. Landing speed, 46 m.p.h. Climb to 5,000 ft., 14 minutes. To 10,000 ft., 38 minutes. Range near ground level at full speed, 403 miles. Petrol consumption per hour, 58 gallons. Oil consumption per hour, 4.2 gallons.

Hull Construction

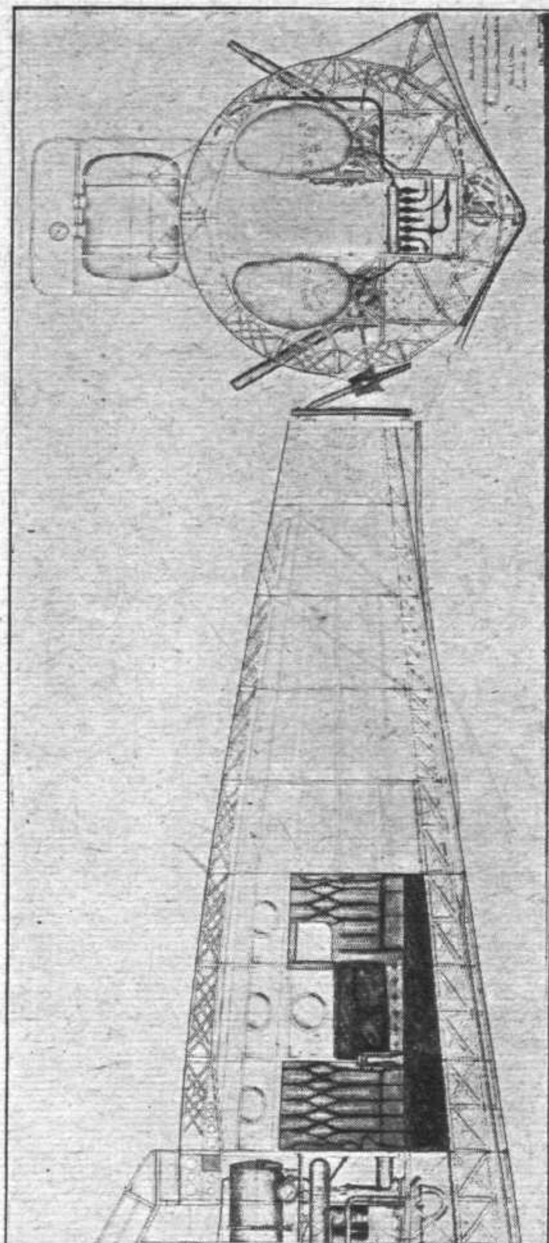
Reference has already been made to the interesting construction of the boat hull of the W. B. IX. Instead of the usual wood longitudinals and transverse formers, this machine has 16 longitudinal Duralumin girders spaced around circular frame girders. Longitudinal as well as transverse girders are built up of top and bottom channels forming the flanges of the girders, braced by light airship type lattice bars. The transverse formers are spaced 2 ft. apart, and are fitted in as segments between longitudinal girders. One of the accompanying illustrations—a longitudinal and a transverse section of the hull—will help to give an idea of the general lay-out.

Such members as keelson and chines are of rock elm, but the structure supporting the chines is a series of duralumin cantilever girders of similar general design to that of the main longitudinal and transverse girders. The outer covering of the hull is also of wood, consisting of two skins of mahogany, of which the inner skin is laid on diagonally, the outer one longitudinally. A layer of fabric is placed between the two skins and varnished and nailed in place, thus adding greatly to the strength and water-tightness of the hull. The lower part of the hull is divided into six watertight compartments, so that in the case of one or more compartments being flooded there is still sufficient buoyancy to prevent the machine from sinking. From the bilge pump a pipe leads to each compartment.

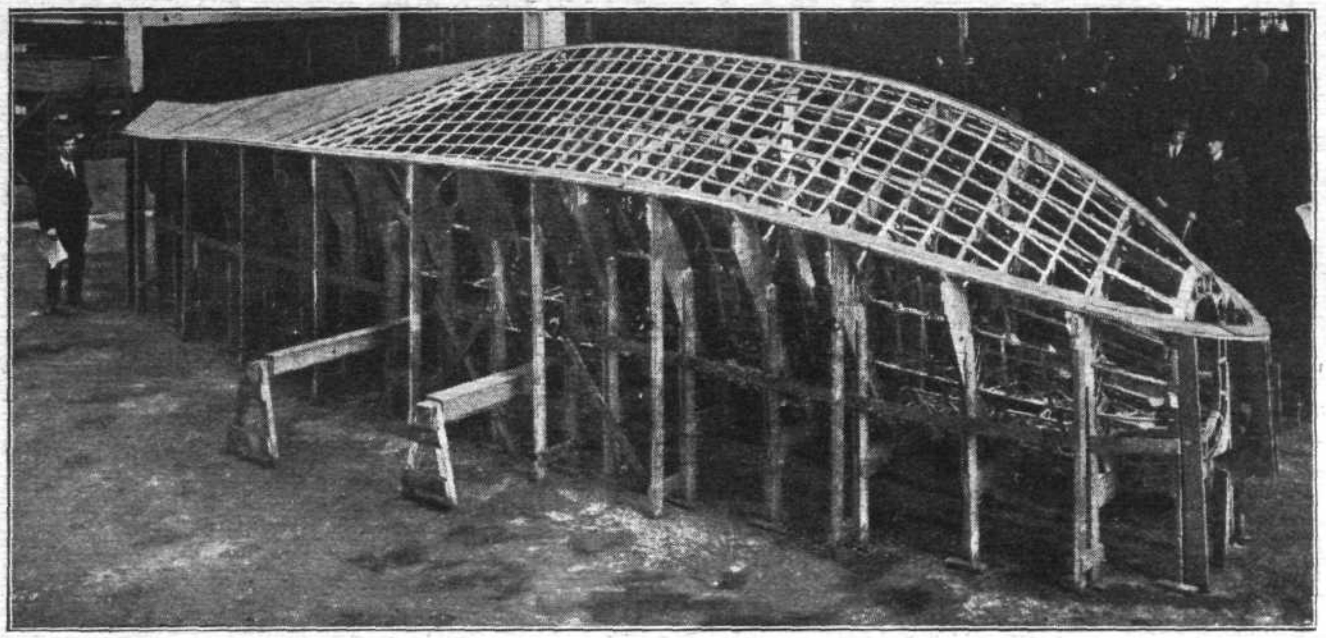
Cabin Arrangements

The passengers' quarters are divided into two compartments by the engine room. The front cabin, in the nose of the hull, seats two passengers comfortably and three without undue crowding. The cabin aft of the engine room is larger and seats four passengers comfortably. There is even room for a table, but if this is not required seating accommodation for six passengers can be provided. If necessary an extra passenger can be accommodated in the pilot's cabin, bringing the total passenger capacity up to 10.

As will be seen from the sectional view of the hull, the pilot is placed in a separate cabin above the engine room. From here he has an excellent view through Triplex glass windows



THE AIR MINISTRY AMPHIBIAN COMPETITION : The Beardmore W.B. IX Flying Boat, four 200 h.p. Beardmore engines. Longitudinal and transverse sections of the hull



THE AIR MINISTRY AMPHIBIAN COMPETITION: Our photograph shows the hull (inverted for planking) of the Beardmore W.B. IX flying boat

in the side. These windows can be raised and lowered so as to provide not only ventilation but also a free view during rainy or foggy weather. A door in the side of the pilot's cabin gives access to a walking-way on the lower plane, while the engine room below is reached *via* a trap-door in the floor and by means of an accommodation ladder.

The Engine Room

Perhaps the most interesting part of the hull is the engine room, in which are installed the four 200 h.p. Beardmore engines. Ample space is afforded in which to move about and attend to the engines during flight, and minor adjustments and repairs can be effected en route, as each engine is provided with a clutch and can be thrown out of gear while being inspected. The engines are arranged in pairs, one pair on the port side and one pair on the starboard side. In each pair the engines are placed with what is normally their propeller ends facing one another, but separated by a gear-box which takes its drive from each end through bevel wheels. Each engine has its clutch—of the multiple plate type, with 26 plates of steel and 26 of phosphor bronze. A flexible coupling is fitted between the clutch and the gear-box to allow of ease of alignment. Another feature which is rarely seen on aero engines nowadays is found on the Beardmore engines of this machine—in the shape of a substantial flywheel. The fitting of this allows of the engine being run free for purposes of testing, and also tends to reduce vibration in gearing and shafting.

From the primary gear-box in the hull a vertical—or more correctly speaking a diagonal—tubular shaft of special axle steel transmits the drive to a secondary gear-box placed between the wings and supported by vee interplane struts. This intermediate shaft is fitted, in the centre of its length, with a self-aligning, anti-whirling bearing, and has sliding universal couplings at each end. The whole shaft is enclosed in an oil-tight casing, and forced lubrication by pumps is employed throughout the transmission drives.

The propeller hubs in front of the secondary gear-boxes are of the full floating-type, *i.e.*, the hubs run on steel extensions bolted to the nose of the gear-boxes and are driven by torsion shafts. These shafts run through the hollow nose pieces, and drive the hubs by means of dogs cut in the shafts and hubs.

The propeller thrust is taken by a ball thrust race at the rear end of the hub.

The propellers, which are placed close together, are of the four-bladed type, with brass tips to protect them against spray. This arrangement of the propellers close together should be of great advantage in case of engine failure. Not only is the "leverage" of each propeller small, but in case of one engine cutting out the other still continues to drive the propeller, although naturally at a reduced speed. Consequently the yawing moment caused by the failure of one engine should not be anything like as great as it is in the case of a machine with the engines on the wings, where not only is the distance between the two centres of thrust usually greater, but in case of one engine cutting out the thrust on that propeller disappears. Not only so, but there is a negative thrust on the airscrew, which adds further to the already considerable yawing moment. If, therefore, the transmission drive of the Beardmore W. B. IX proves satisfactory, the type should have much to recommend it.

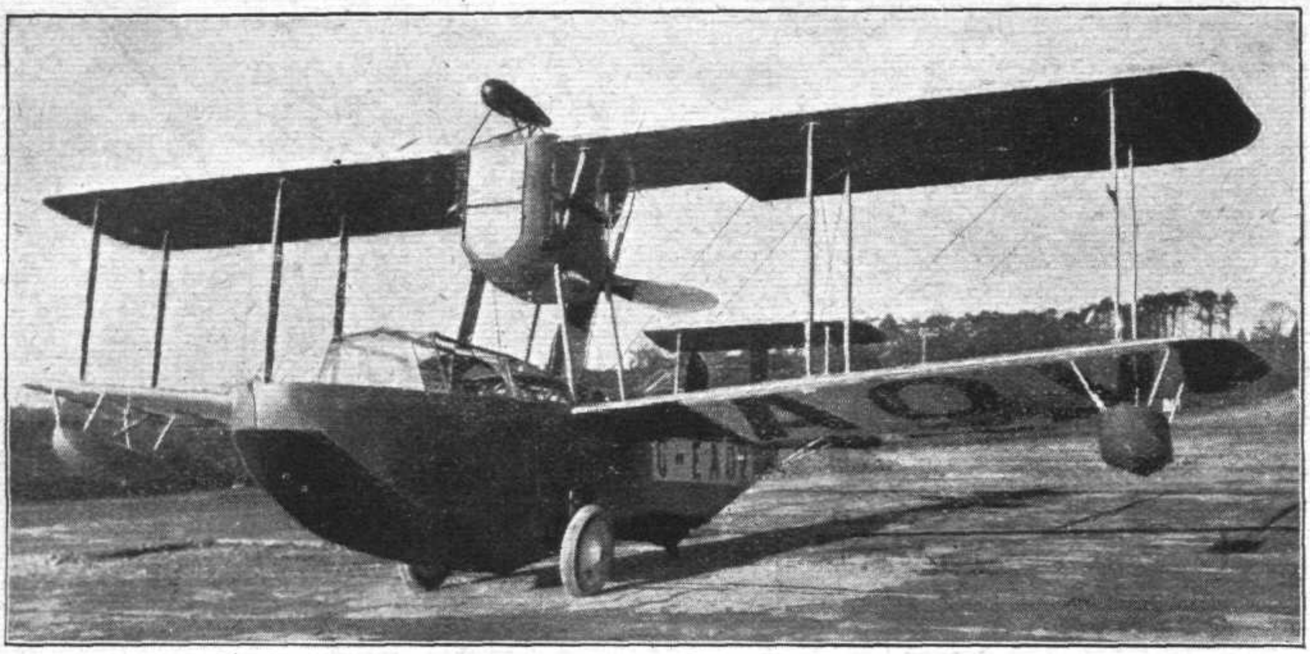
Petrol System

There are in all seven petrol tanks on the machine. Over each engine is a gravity tank, supplied from the main tank by gravity feed. The main tank is placed aft of the pilot's seat, in the coaming behind the cabin, and a further two tanks are hung near the sides of the engine room itself. Petrol is pumped from these two latter tanks—which may really be regarded as reserve tanks—by Austin glandless pumps, driven from engines when required. Ample size piping is fitted, and all flexible connections are made with braided flex hose, no rubber joints being employed. The fuel is passed through a central distributor and is thoroughly filtered. Alternative supply piping is arranged to all engines in case of pipes or connections being damaged. The petrol tanks are of welded aluminium and the oil tanks of 24 gauge tinned steel.

The Undercarriage

The "amphibian" part of the landing gear is in the form of two large Palmer aero wheels mounted on a hinged vee-structure, which is folded by means of the hinged rear struts. The raising and/or lowering of the undercarriage is done from the engine room, and is in charge of the engineer. The shock-absorbing arrangement is in the form of rubber cord and "Oleo" gear, and stops are provided to limit the movement of the axle. The track of the undercarriage is wide—about 16 ft.—and should give good stability on land. The tail skid acts as a skid when the machine is alighting on or taking off from land, and performs the function of a water rudder when the machine is operating on the sea. It is formed of steel plate, and sprung by rubber shock absorbers. The two wing tip floats are built-up of a framework of duralumin covered with mahogany.

Whatever are the results obtained in the competition, Messrs. Beardmore and Co. are to be congratulated upon their courage in making such a radical departure from orthodox design and tackling a problem which must be attacked sooner or later, and one wishes them every success. That the machine is a bold experiment may be admitted, incorporating as it does a number of more or less unknown quantities, such as duralumin construction and transmission drive to the propellers, features which may, and probably will, require lengthy experiments before being successfully developed, but at a time like the present, when so many firms are withdrawing from the industry on account of no immediate profits being forthcoming, it is refreshing to see a firm which is not afraid of looking ahead, and which has the foresight necessary to set out boldly to break new ground, knowing that immediate success—and its reward—is not likely to be arrived at. We think that this attitude on the part of a firm of this standing augurs well for the future of commercial aviation.



THE AIR MINISTRY AMPHIBIAN COMPETITION: The Vickers "Viking," 360 h.p. Rolls-Royce Eagle Engine

The Vickers "Viking." Rolls-Royce Eagle Engine

The machine entered by Messrs. Vickers, Ltd., is of the type exhibited recently at Olympia, where it attracted a good deal of attention. It is the "Viking" model flying boat with a retractable undercarriage, and has already been thoroughly tried out over Southampton Water and the Solent. During the Olympia show films were shown of this machine getting off and alighting on the sea, as well as on land. Its excellent behaviour was clearly brought out in the films, and there is little doubt that the machine will do well in the Felixstowe competition. As the "Viking" has already been fully described in FLIGHT, there is no need to go into details again. Suffice it to recapitulate the main specification figures as follows:—Length, 32 ft. Span, 46 ft. Area, 505 sq. ft. Weight empty, 2,740 lbs. Weight fully loaded, 4,545 lbs. Load per sq. ft., 9 lbs. Load per h.p., 13 lbs. Maximum speed near ground, 110 m.p.h. At 6,000 ft., 105 m.p.h. Range at 6,000 ft. and full speed, 395 miles. Range at 6,000 ft. and a cruising speed of 90 m.p.h., 440 miles. Climb to 6,000 ft., 11 minutes. When the Rolls-Royce Eagle is throttled down to give a cruising speed of 90 m.p.h. it is developing approximately 270 h.p., thus leaving a good reserve of power available in case of emergencies such as adverse weather conditions, etc. The paying load of the "Viking" is about 1,000 lbs., so that the machine should be a very good commercial proposition. For instance, it should be capable of the direct trip across the North Sea from England to Denmark with a commercial load of at least 800 lbs. (the remaining 200 lbs. being used for reserve fuel to ensure the necessary range of 400 miles in case of head winds).

Concerning the remaining machines entered we regret that no information is available for publication at the time of going to press. It is rumoured that some of them will not be ready in time for the competition.

THE ROYAL AERO CLUB OF THE U.K.

OFFICIAL NOTICES TO MEMBERS

INTERNATIONAL AIR RACES

THE Racing Committee of the Royal Aero Club has selected the following Competitors to represent Great Britain in the race for the Gordon Bennett Aviation Cup, which will be held at Etampes, France, on September 28, 1920:—

Pilot	Machine	Engine
H. G. Hawker..	Sopwith-Jupiter ..	450 h.p. "Bristol" Jupiter.
F. P. Raynham	Martinsyde "Semi-Quaver"	300 h.p. Hispano-Suiza
L. R. Tait Cox..	Nieuport "Gos-hawk"	320 A.B.C. Dragonfly.

It is regretted that up to the present no British entries have been received for the Jacques Schneider International Seaplane Race to be held at Venice on September 19, 1920.

August 26, 1920.

Offices: THE ROYAL AERO CLUB,
3, CLIFFORD STREET, LONDON, W. 1.
H. E. PERRIN, Secretary.

Memorial to R.N.A.S.

AN appeal signed by Rear-Admiral Murray F. Sueter has been issued in connection with the proposed memorial to the officers, warrant officers, petty officers, and men of the Royal Naval Air Service and the Royal Naval Armoured Car Division who fell in the War. The memorial is to take the practical form of a row of cottages, with an inscribed tablet, on the Enham Village Centre Estate, for disabled ex-Service men, at Andover, Hants. Although these two offshoots of the Royal Navy ceased to exist as separate units before the end of the War, those who served in them will no doubt be glad of this opportunity of perpetuating the memory of their comrades who fell in every part of the world where the Royal Navy and the Army were engaged.

Cheques and postal orders should be sent to Sir Frederick Milner, Bt., or G. Bromley Martin, Esq., Village Centres Council, 10, Upper Woburn Place, W.C. 1, and crossed National Provincial and Union Bank of England Ltd., and envelopes marked R.N. on top left-hand corner. As a complete list of donations will be published, it is hoped to arrange a re-union in London through the record which will thus be obtained.

R.A.F. Officers' Commission Papers.

THE Air Ministry announces:—

Several announcements have been issued to ex-R.A.F. officers requesting them to forward their present addresses in order that the Air Ministry may be able to complete the dispatch of their formal commissions in the Royal Air Force. Of those issued more than a thousand have been returned, and in addition there are several thousands of officers whose addresses are unknown. Amongst them are about 2,000 Colonial cadets who were given honorary commissions after the Armistice.

It would greatly assist the Air Ministry if all ex-officers who have not yet received their formal commissions would forward immediately their addresses to the secretary, Air Ministry (S. 7), Kingsway, London, W.C.2.

THE APPROACH OF TWO CLASSIC RACES

The Schneider and the Gordon-Bennett

THIS month will see the flying of two races which have become classic in the world of flying: the seaplane race for the Schneider Cup, to be flown at Venice, and the Gordon-Bennett aeroplane race, which will be held this year at Etampes, near Paris. The Jacques Schneider race is to be flown over the sea outside the Lagoon of Venice on September 19, 1920, the machines entered having to pass a test of seaworthiness on the previous day. The Gordon-Bennett race at Etampes will be flown on September 28, 1920, and, like the Schneider race, is a speed competition pure and simple.

The last Schneider race was, it may be remembered, held at Bournemouth on September 10 of last year, when foggy weather played havoc with the arrangements and there was a good deal of controversy as to whether or not the affair should be considered a race at all. Finally, after much talk and many heated discussions in the Press and elsewhere, it was decided to award the race to Janello, although there was some doubt as to whether or not he had actually covered the course in order. By the majority it was considered that Janello thoroughly deserved the award of the cup for the plucky way in which he kept on piling lap upon lap under weather conditions which were extremely dangerous. The result of the award is that the race is to be held in Venice this year, and it is very much to be regretted that it is now announced by the Royal Aero Club that no British entries for this classic race have been received. The future of this nation in the air will certainly be closely related to the development of the seaplane, and the Schneider race provides a splendid opportunity of showing the world what British seaplanes can do. We have not the slightest doubt that our constructors could produce machines capable of beating anything that is likely to be put up against them at Venice, but the mere fact of refraining from competing will be taken by the world at large as a sign of lacking confidence in the result.

A splendid opportunity of scoring heavily over the competitors of other nations was lost by the British Aircraft Industry at Monaco in April of this year, when the only machine entered was a Fairey, and that had to be scratched at the last moment, owing to the impossibility of finding at a moment's notice a pilot to take the place of Capt. Nicholls, who was called to America suddenly. The prestige of British sportsmanship, which received a severe blow at Bournemouth last year, is not likely to be enhanced by the absence of any British aircraft to challenge the seaplanes of France and Italy at Venice this year.

In the accompanying sketch-map is indicated the course for the Schneider race at Venice. The total distance to be flown is 200 sea miles, and a triangular course has been mapped out, of which the three legs are respectively 11, 13, and 13.117 kilometres. This gives a distance of 20 sea miles, so that the competitors will have to make 10 laps of the course. In our sketch map the dotted line joining the points B_1—C_1 indicates the lower leg of the course for the test of seaworthiness, which is to be held on September 18 over the course A—B_1—C_1. The speed race, to be flown on the following day, is over the course A—B—C. The three turning points will be indicated by captive balloons flying at a height of 50 metres over the sea. The starting and finishing line indicated by the letters *a—a*, at right angles to the course A—B, will be marked by two buoys, to one of which will be anchored the boat of the timekeeper.

The Seaworthiness Tests

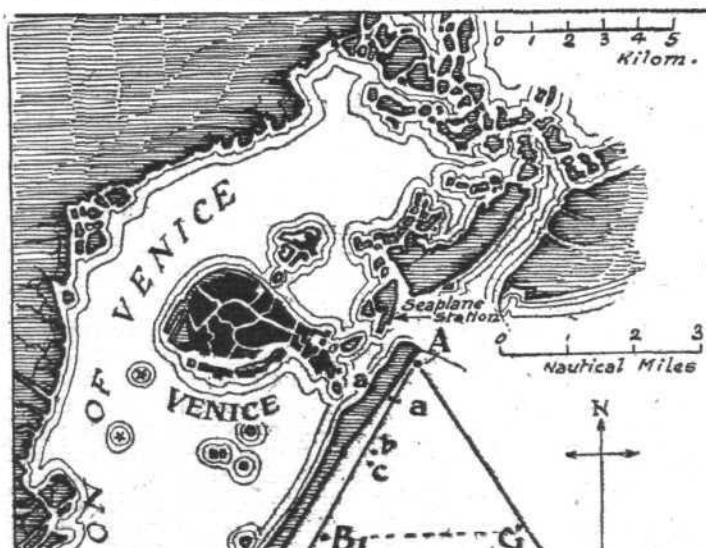
In the test for seaworthiness the competitors must start from the point A and, taxying over the starting line at not more than 10 sea miles per hour, they will rise and fly to the point *b*, where a landing must be made and the 300 metres distance from *b* to *c* again has to be covered, taxying at not more than 10 miles per hour. Having passed the buoy at *c* the competitors rise and round the balloons at the turning points B_1, C_1 and A, alighting again and passing the finishing line *a—a*, taxying at not more than 10 miles per hour.

In case of damage to boat or floats competitors must repeat the test after having effected the necessary repairs, on the same day and before the hour corresponding to sunset (7.48 p.m.). Under no circumstances will competitors be allowed to change the boat or floats, or the propeller of their machines.

The Speed Contest

As already mentioned, the speed contest itself consists of 10 laps of the course A—B—C. The starting line is again at *a—a*, and the competitors will be sent off at intervals of five minutes, finishing after completing the 10 laps of the course by crossing in flight the line *a—a*.

At the moment of writing it is not possible to give a list of the machines entered for the Schneider race, but probably there will be Savoia and Macchi flying boats to represent Italy and possibly Spad and Nieuport seaplanes representing France. Whether any other countries will be represented is not yet known, but this is rather doubtful. Thus the absence of British competitors may not only be regrettable from the national point of view, but may quite conceivably result in the total abandoning of the race for this year, which would be a great pity owing to the world-wide interest such an event always creates.



THE SCHNEIDER CUP RACE: Sketch-map of the triangular course outside Venice

The Gordon-Bennett Race

After an interval of seven years the classic Gordon-Bennett race, in which speed is the only consideration, is to be resumed at Etampes near Paris. The speed course this year is somewhat longer than that of 1913, being 300 kilometres (186 miles). Before discussing the speeds that will probably be attained at this year's Gordon-Bennett race it may be of interest to look back and recall the winners and speeds established by them in the previous races. The first Gordon-Bennett was held in 1909, and was won by Glenn Curtiss on a Curtiss biplane. On this little light machine Curtiss won the race with a speed of 43 m.p.h. This figure is apt to be the cause of smiles when one thinks of the speeds of which modern machines are capable, but in those days it was a very respectable speed, and Curtiss won much praise both for his piloting and for the design and construction of the machine. The race of 1910 was flown in America, and was won by Mr. Grahame-White on a Blériot monoplane. His speed was 63 m.p.h., a considerable increase on the previous year's record. The winning by Mr. Grahame-White of the race brought the contest of 1911 to this country, where it was, for the first and only time, flown at Eastchurch, Isle of Sheppey. It will probably still be remembered, at any rate by our older readers, how on that occasion the late Mr. Gustav Hamel was flying a Blériot monoplane, the wings of which were cut down to such an extent that the machine became positively dangerous. In doing a turn Hamel sideslipped and crashed to the ground. Fortunately he was not seriously injured and was soon flying again. The race of 1911 was won by Weymann on a Nieuport monoplane, who raised the speed to 78 m.p.h. Thus Weymann became the second American winner of the Gordon-Bennett, and consequently the race of 1912 was held in America. This proved to be somewhat of a fiasco, the machine entered by

America not being ready in time, and the two British entrants —Hamel and Grahame-White—being unable to go across. This narrowed down the competitors to the three French entrants: Jules Vedrines, Prevost, and Frey. Vedrines and Prevost were flying Deperdussin monoplanes, and Frey was piloting a Hanriot. Frey had to retire before completing the race, which was won by Vedrines at a speed of 105 m.p.h., Prevost's speed being 103.8 m.p.h.

The last Gordon-Bennett race to be held before the war was flown at Rheims in 1913, and was won by Prevost on a Deperdussin, whose speed averaged 124.5 m.p.h. This did not, however, represent the actual speed of the machine, which was very much higher, probably not very far short of 135 m.p.h. The landing speed of the Dep. was appallingly high (for those days), and the machine ran along a couple of miles before coming to a standstill. It was generally agreed that should Prevost's engine fail he would stand very little chance, as the gliding angle of the machine was very poor. However, his engine did not fail, and the course was completed without accident. One hopes that this year's race may pass off without a serious mishap to any competitor. The landing speeds are certain to be very high, but aero engines of to-day are considerably more reliable than were those of 1913. It is a question, however, whether it is not time the rules for the Gordon-Bennett were altered. For the race of 1914, which was postponed owing to the outbreak of War, a proviso was contemplated, according to which the machines, before being allowed to compete, were to have a certain minimum speed. This would have had the effect of reducing the maximum speeds attainable, but would probably have produced machines of greater utility. On the other hand, it may be taken that designers and pilots themselves are the best judges of what is the permissible landing speed of a racing machine, and that thus it is not necessary to put any limit other than that imposed by the entrants themselves. In any case the mere settling upon a certain low speed as being the maximum allowable is not likely to be any more effective in reducing the risk of accidents than is leaving it to the competitors, since what may be a perfectly safe speed for a given machine and pilot may be a dangerous landing speed for another machine and pilot. So perhaps, everything considered, the rules may be left as they stand. One thing is certain, the speeds which will be established this year at Etampes will far surpass those of 1913.

The Machines and Pilots

At the moment of writing twelve machines have been entered for the Gordon-Bennett race—three by Great Britain, three by France, three by Italy, and three by U.S.A. The three British machines and their engines and pilots are:— Martinsyde "Semiquaver," 300 h.p. Hispano-Suiza engine, F. P. Raynham; British Nieuport L.S.3, 320 h.p. A.B.C. "Dragonfly," L. R. Tait-Cox; Sopwith machine, 450 h.p. Bristol "Jupiter," H. G. Hawker. The machines entered in France are two Nieuports and two Spads and a Borel. The eliminating trial is fixed for September 25. One of the Nieuports will be flown by M. Sadi Lecointe, and the two Spads by Casale and de Romanet, all three well known from the Monaco race and other events. Their three French machines will be fitted with 300 h.p. Hispano-Suiza engines.

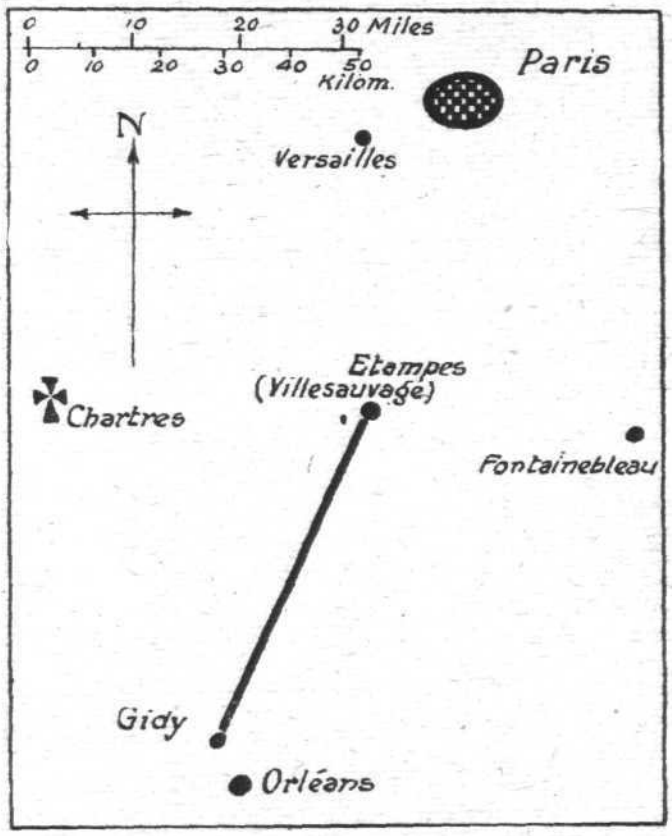
Both the Nieuport and Spad machines have established records for speed, the Spad being credited with a speed of 176 m.p.h., while the Nieuport is probably very little slower. The British Nieuport (which, by the way, has no resemblance to the French Nieuport) established a speed at Martlesham recently of 166.5 m.p.h., and the new Martinsyde is certainly capable of a speed at least equal to that of the Nieuport. The three machines entered by Italy have not yet been announced, but three very fast 'buses are expected from America.

These are: Verville-Packard, 500 h.p. Packard engine, piloted by Major R. W. Schroeder; the Curtiss Texas "Wildcat," 400 h.p. Curtiss engine, piloted by Roland Rohlfs; and the "R.B." monoplane entered by the Dayton-Wright Co., which has a span of 22 ft. 6 ins. while its body is 22 ft. long. The R.B, wings are of rigid cantilever construction, covered with three-ply veneer. When the machine is in flight the wheels and entire landing gear are drawn up inside the body. The machine is also fitted with a variable camber device operated by the same control as that which works the retractable chassis.

The body is of the monocoque type, made of thin strips of wood bound tightly with strips of fabric laid in glue, the strips criss-crossing the underlayer each time that a layer of wood is applied. The pilot sits inside of the machine completely enclosed by the door, which opens on either side just back of the point where the wings cross the top of the body as though laid over it.

The machine is fitted with a special 250 h.p. Hall-Scott racing engine of the Liberty six type. The pilot will be Mr. Howard M. Rinehart, who with Milton C. Baumann designed it.

Some of these American machines are credited with tremendous speeds; the figure of 200 m.p.h. is mentioned in an awed whisper, but this need scarcely be taken too literally. However, it is not unlikely that some of the machines may reach a speed in the neighbourhood of 180 m.p.h. Then there is the Sopwith machine, which is at present somewhat of a dark horse. It may be remembered, however, that the Sopwith Schneider machine of last year, which also had a 450 h.p. Jupiter engine, did well over 160 m.p.h., and a machine of similar design, fitted with smaller wings and the same engine would undoubtedly be very fast indeed. Hawker has had some very bad luck in racing of late, and one wishes him better luck in the Gordon-Bennett. If he can obtain his Jupiter engine in time he may be relied upon to put up a fine performance.



THE GORDON-BENNETT RACE: Sketch-map of the straight-line course from Etampes (Villesauvage) to Gidy. The distance is 50 kilometres, and competitors have to make three journeys out and home

Altogether this year's Gordon-Bennett looks like being one of the most interesting sporting events seen for a long time. The speeds which will be put up will be tremendous, and as there will probably not be a very great difference in the speed of the competing machines a good deal will depend on the piloting—which is merely another way of saying that for pure sport the event will be one of surpassing interest. Incidentally it may be mentioned that at least two of the machines entered will be monoplanes, which should provide an interesting comparison between that and the more usual biplane. There was a time when the monoplane was looked upon as *the* machine for speed. Then Sopwith demonstrated by their little 80 h.p. "Tabloid" that the biplane could be made very fast. Since that time the monoplane has practically disappeared, and its revival in the present race would seem to indicate that some designers consider it superior to the biplane for a pure speed machine. Time will show who is right.

Another Looping Record

One of the items on the programme of the opening of the Curtiss Aerodrome at Garden City, on August 15, was a looping demonstration by Miss Laura Bromwell. From a height of approximately 6,000 feet she made 43 consecutive loops which were noted by the observers, and she continued looping, although lost in the mist. She was credited officially with a total of 87 loops. Her mount was a Curtiss Standard J-1 'plane with a K-6, 150 h.p. motor.

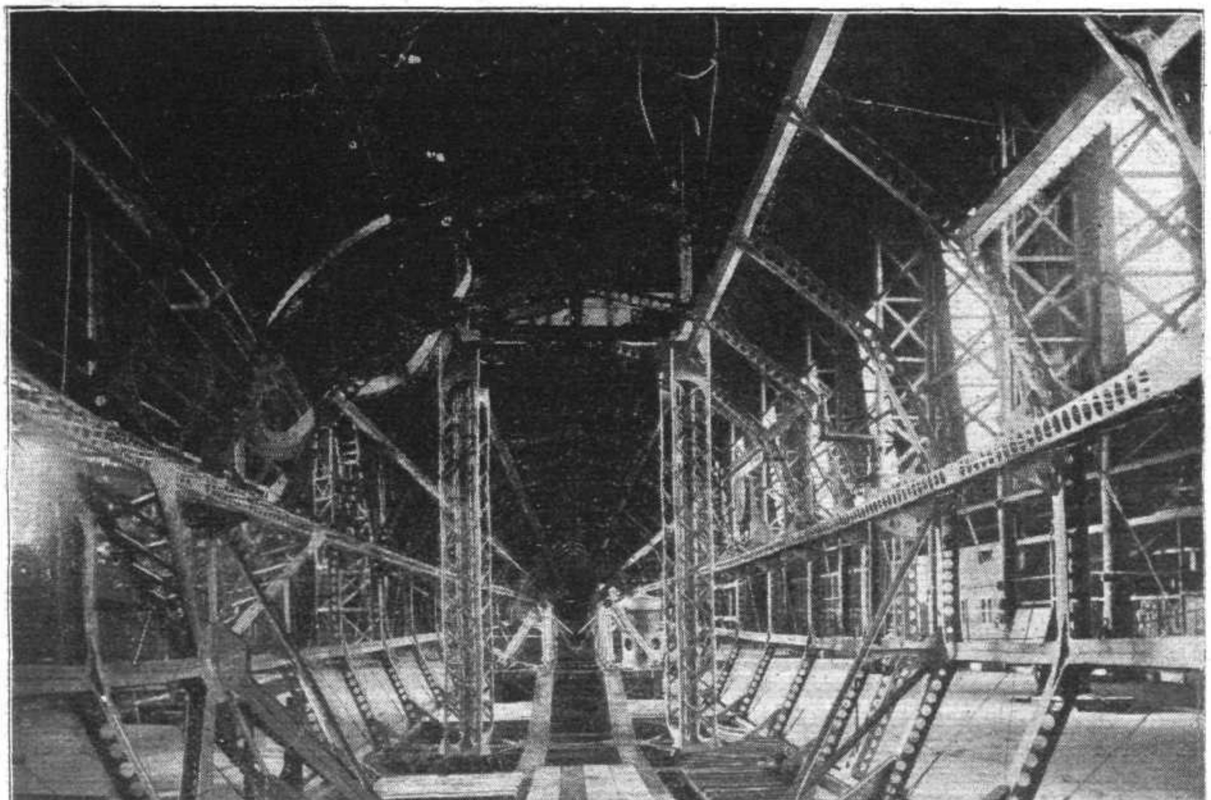
AIRSHIPS

H.M. AIRSHIP "R. 80"

A Description of the New Vickers-Built Rigid Airship

(*Concluded from page* 929)

THE construction of these valves will be clear from an inspection of Figs. 24 and 25, which illustrate the automatic and manœuvring valves respectively. Fig, 20 shows the operation of inflating the gasbags in progress, the bags being about half full, and also shows the fitting of the outer cover, which is made in a number of separate panels laced to the girders; the joint space is afterwards covered with a sealing strip. A walking way and hand-line runs along the top of the hull, and there is also a gun platform forward, access to which is obtained by means of a climbing tube running up between two of the gasbags. This gun platform can be distinguished in the general view, Fig. 17. Ventilation shafts, shown in Fig. 18, are placed between the gasbags—one to each pair of bags, to allow any gas discharged by the automatic valves to escape, and also to ventilate the corridor.

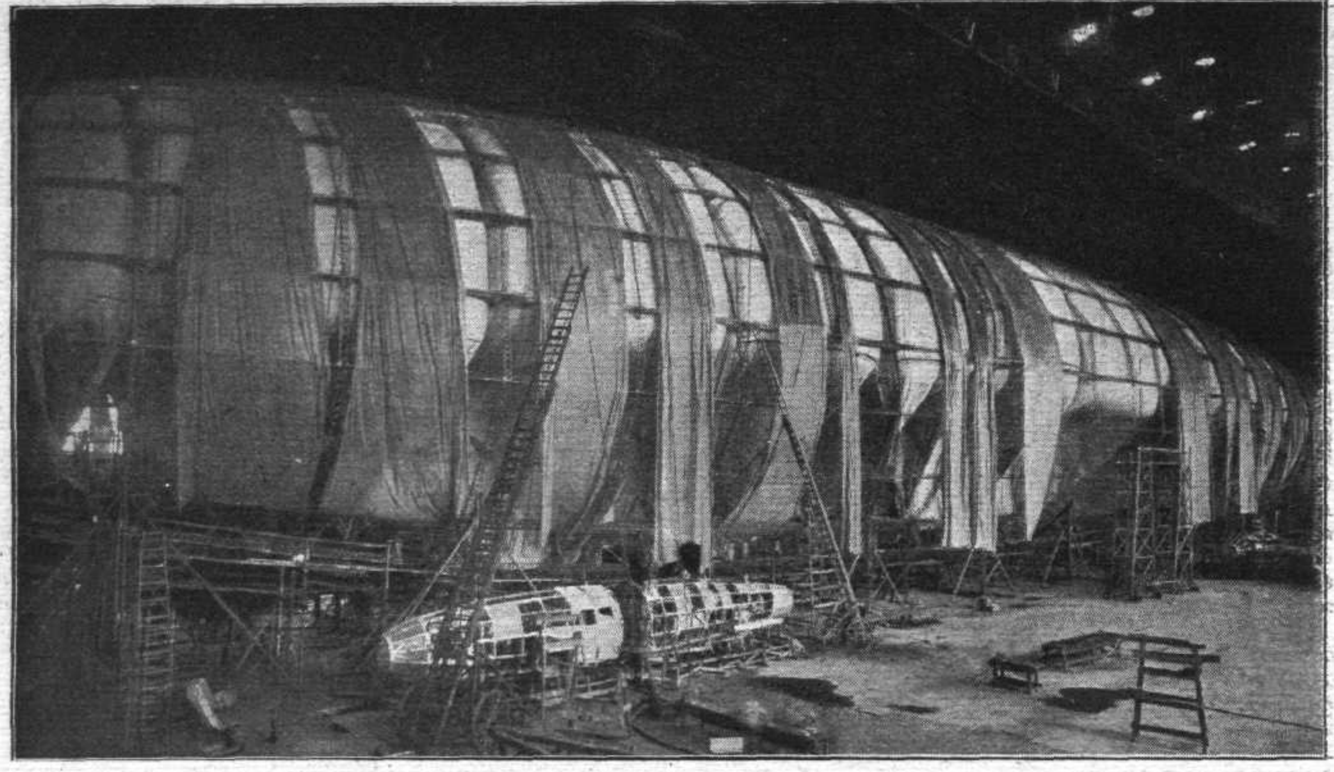


The "R.80." —Fig. 19: Framework of wing car, showing radiator slides and engine bearers

The arrangement of the vertical fin and rudders is shown on the left of Fig. 1, while Fig. 2 is a similar illustration of the horizontal fin and elevators. The framing of these parts is shown, respectively, in Figs. 4 and 5. The fin girders are of similar construction to the hull girders. The top and horizontal fins each have an area of 715 sq. ft., whilst the bottom fin has an area of 380 sq. ft. The top rudder and elevators each have an area of 250 sq. ft., and the bottom rudder an area of 150 sq. ft. The unbalanced load due to the overhang of the elevators is taken up by a spring working through a fusee, which equalises the load throughout the travel.

There are actually four cars suspended from the hull, although as the two forward cars are placed one immediately behind the other and are joined together flexibly to form one streamline shape, the statement made at the outset that the ship is provided with three cars is practically correct. The forward cars are suspended centrally under the keel of the ship towards the nose, their longitudinal position being shown in Figs. 1, 3 and 4. Figs. 11 to 16 show the construction and arrangement of the cars in detail. The forward car of these two is used for navigating the ship, and contains all navigating controls and instruments, as well as a separate compartment for the wireless apparatus and operator. The after car accommodates two engines driving a single pusher airscrew. Fig. 22 is an interior view of the control and navigating compartment, looking forward, and showing the engine telegraphs, inter-communication telephones, mooring controls and water-ballast controls, and an exterior view of the framework of both cars is given in Fig. 26. The ship is also fitted with two wing cars placed amidships on either side of the centre line, as will be clear from the end elevations and cross sections of the ship, Figs. 6 to 10. Both cars are suspended from the same frame, and each car contains one set of engines. An internal view of one of the wing cars, looking aft, and showing the aluminium framework in which the radiator slides, is given in Fig. 19. In the background of this view the tubular construction of the engine bearers is also visible. Fig. 23 is an interior view of the completed car, looking aft, and showing the control positions and radiator slides. One of the radiators is partly visible in this view, as also are the flexible tubes conducting water to and from the radiator. An external view of the framework of this car is also given in Fig. 27, in which view the engine can be distinguished inside.

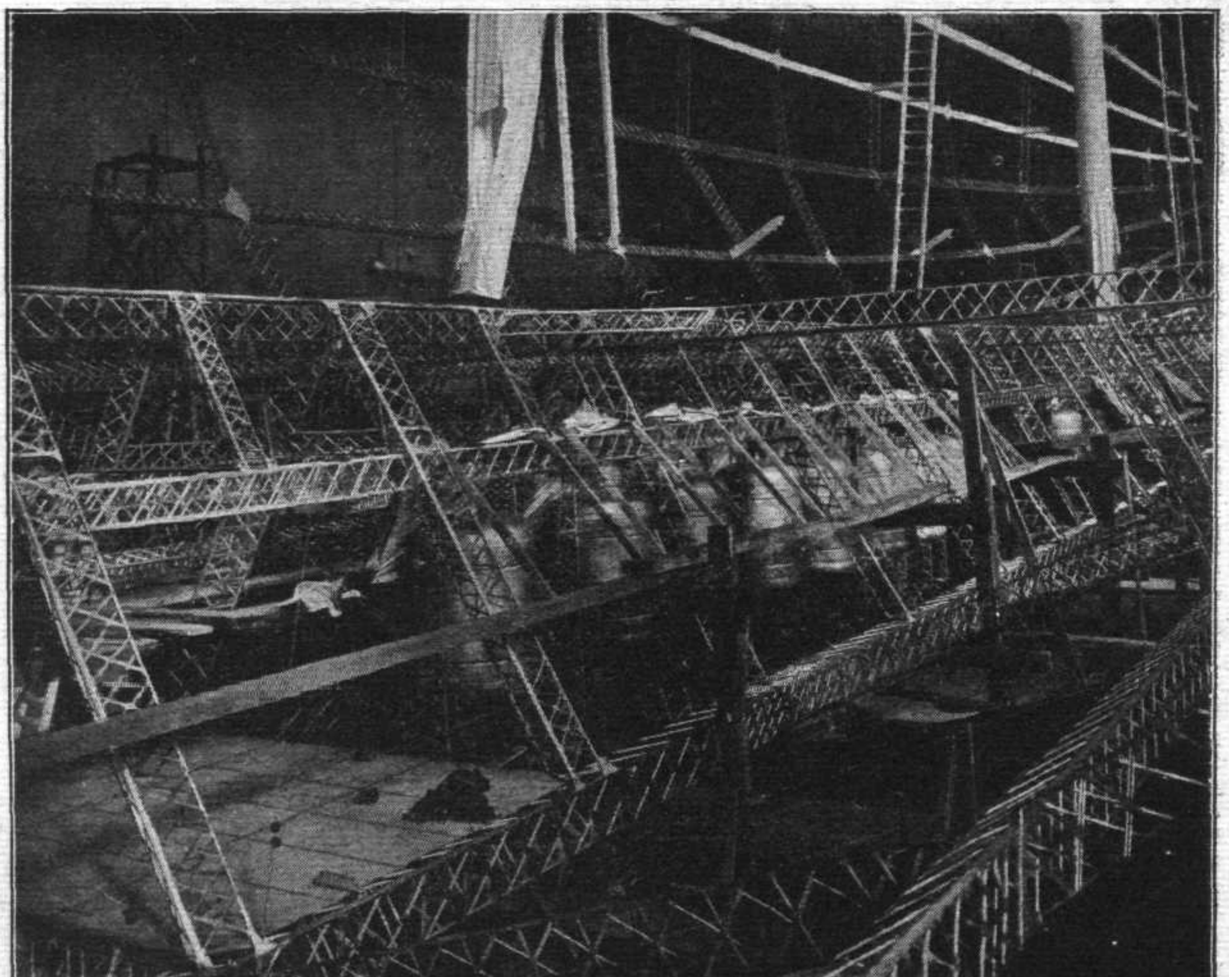
All the cars have been specially designed to give, as nearly as practicable, a perfect streamline shape. They are con-



The "R.80."—Fig. 20 : Airship being inflated. The gas bags are about half filled

structed of duralumin sections, and in the case of the machinery cars are plated on the lower portions and covered, in way of the engines, with asbestos fabric. The control car is entirely covered with ordinary fabric. Opening windows of "Triplex" glass are fitted where required, and opening and fixed windows of non-inflammable celluloid are provided in positions of less importance. Portable sections are arranged in the sides of the machinery cars to facilitate removal of the engines. Handling rails are provided, and access to the keel is obtained by means of ladders encased in streamline tubes. All the cars are fitted with special inflated buffer bags, shown in Fig. 11, which have sufficient buoyancy to enable the ship to alight and float safely on the water; they also make an effective cushion when landing on the ground. All the controls from the forward navigating car are conducted aft under the deck af the car, and up through the access trunk to the keel, whence they are taken either forward or aft. Along the keel all controls are operated

The "R.80." —Fig. 21 : Framework of corridor, showing petroltanks



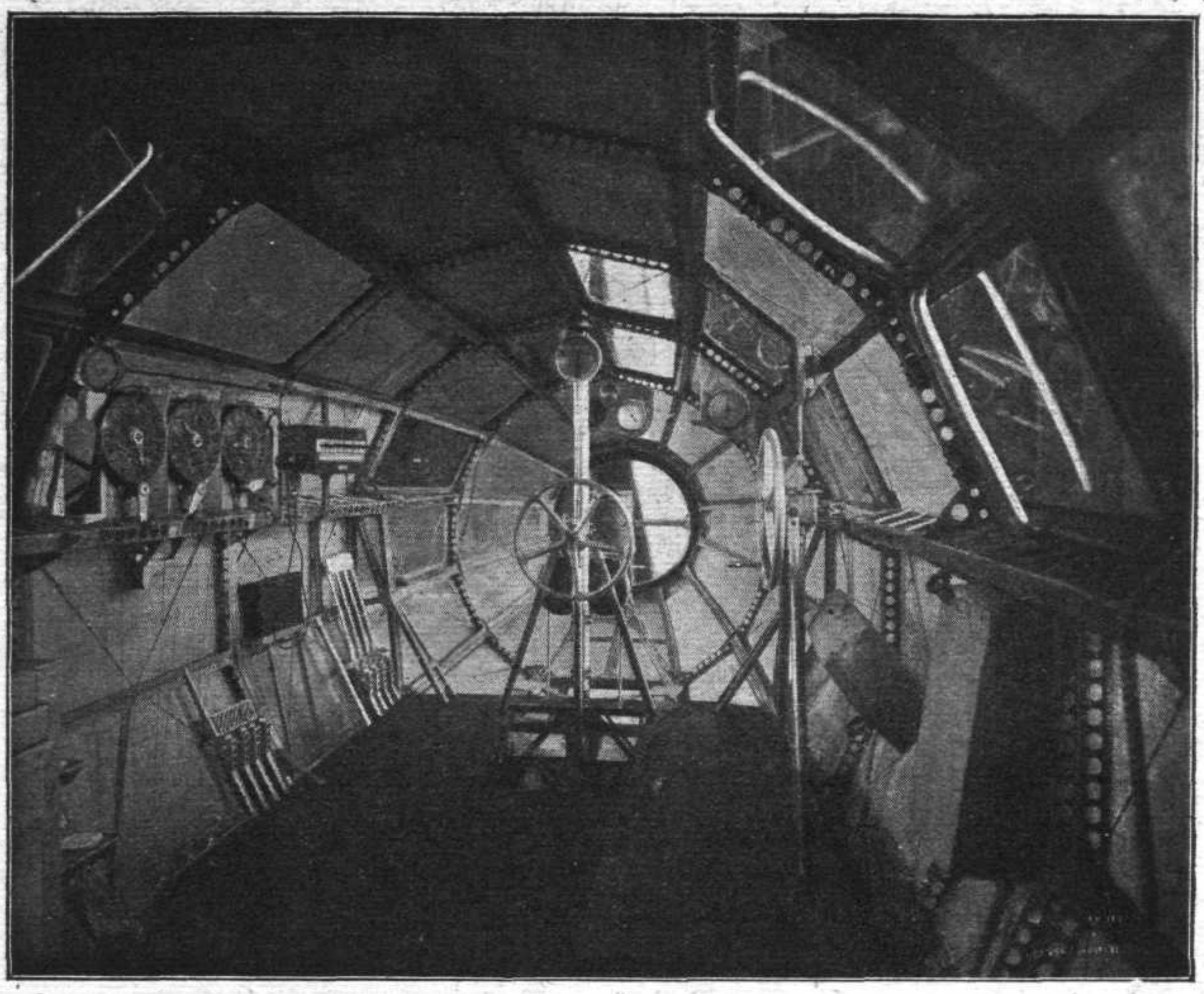


Fig. 22.—Control and navigating compartment of forward car

by means of wires which run through fairleads placed at frequent intervals; pulleys are only employed where a change of direction is necessary. All wires, pulleys and shafts between the cars and the keel are faired in by the access trunk. The rudders and elevators are required to work through a total angle of 40 deg., and to obtain this angle

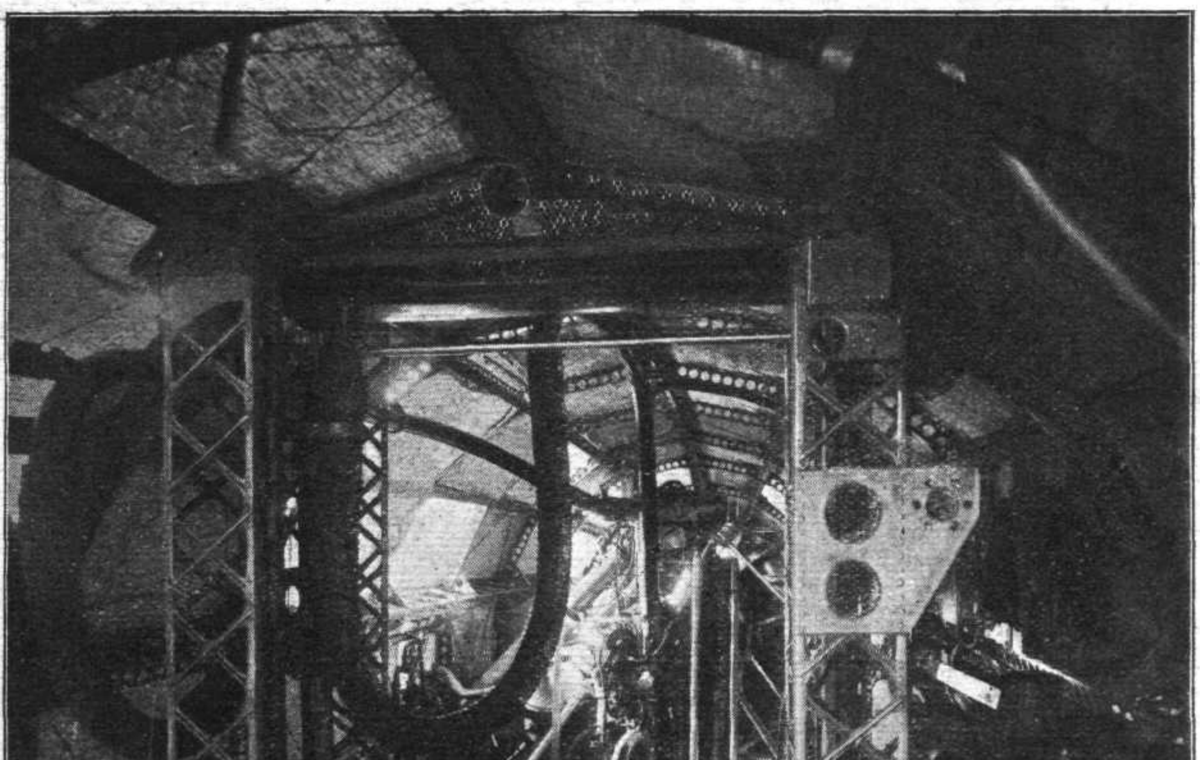


Fig. 23.—Interior view of wing machinery car, looking aft

12 turns are necessary on the steering wheel in the car. The travel of the connected end of the kingpost on the rudder or elevator is 3 ft. From the handwheel position to the keel, the gear consists of torsion shafts and mitre gear-boxes. These shafts run down from the handwheel aft under the car deck, and thence up to the keel through the access trunk. Under the deck the shafts are provided with flexible joints to ensure free running under load conditions. Universal and sliding joints are fitted on the vertical shafts to the keel, their function being to prevent the controls from being rendered inoperative by a faulty landing. The vertical shafts operate a bevel gearbox with a 3 : 1 reduction situated in the keel. The slow speed shaft from this gearbox runs athwartships, and drives a chain sprocket, the chain of which is connected to the main operating wire which runs along the keel to the kingposts. At the aft end of the ship the use of large diameter pulleys is necessary to conduct the wire to the various kingposts, and these pulleys are mounted on suitable points of the hull structure. Large luminous indicators are provided in the control car to indicate degrees of helm and of elevation.

The gas valve controls are operated by wires which run with the other controls until they are conducted up between the gasbags, the latter being protected by fairing tubes short propeller-shaft. An examination of Figs. 11 and 12 will make the arrangement clear. A hand brake and drum are fitted on the propeller-shaft to lock the propeller in a horizontal position when landing, and each engine may be uncoupled from its pinion drive by means of sliding dog clutches. In the wing cars the drive from the engines is taken through a plate clutch to a gearbox at the aft end of the car, on which the propeller is mounted. A hand brake is provided at the aft end of the gearbox to control the propeller. Reversing gear is fitted in the gear-boxes of the wing cars comprising a lay-shaft with a sliding spur wheel. A dog clutch is fitted, so that, when running ahead, the propeller is driven directly at engine speed. All engine controls are arranged to be operated by one man at the control position in each car, as shown in Fig. 23.

Each engine is cooled by a separate radiator, the outside (or block) dimensions of which are about $37\frac{3}{4}$ ins. square by $5\frac{1}{2}$ ins. thick. The water capacity of each radiator is 11 galls., and no separate reserve tank is used. To allow for varying conditions of running, and to ensure that the air resistance of the radiators shall be a minimum consistent with the cooling required, each radiator is mounted in a vertical slide, above referred to, in which it can be raised or lowered by means of a small worm gear winch, so that only

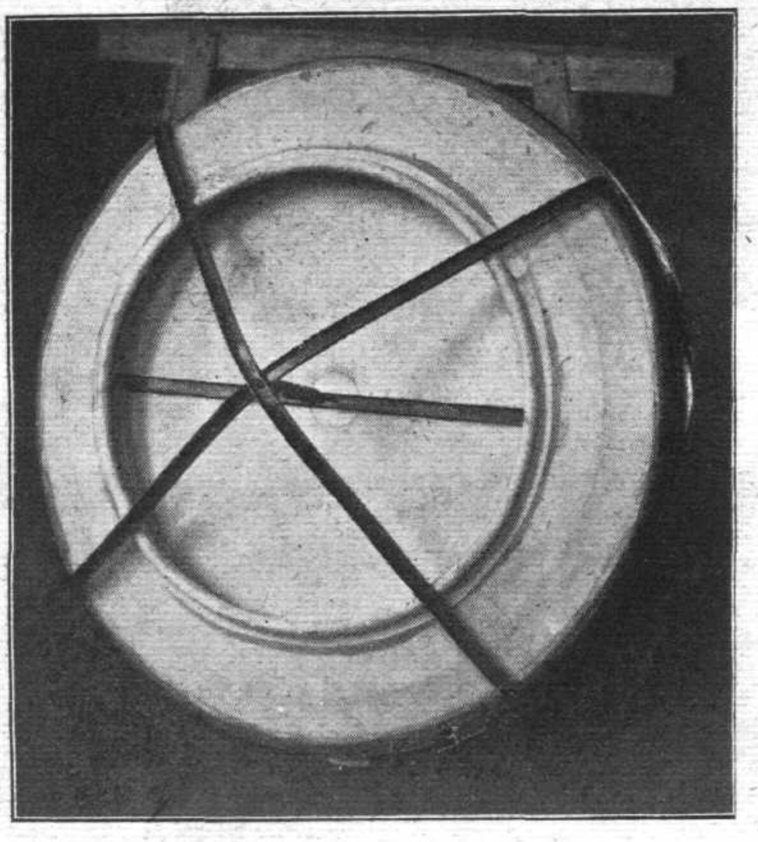


Fig. 24.—Automatic gas valve

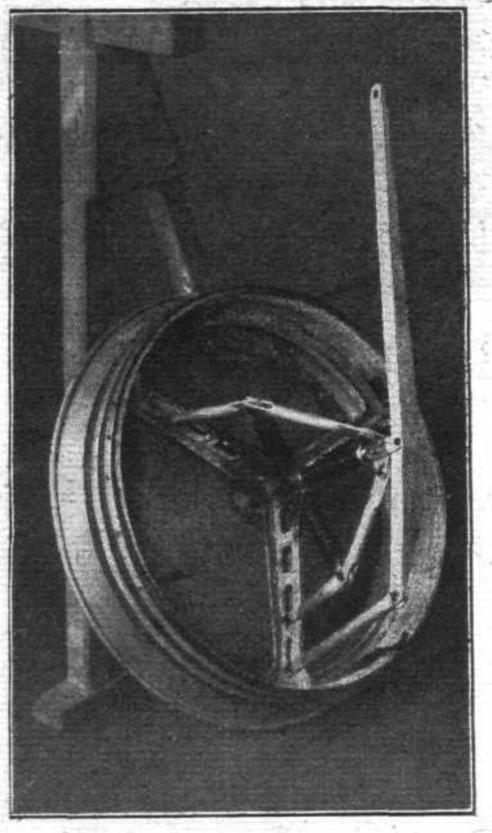


Fig. 25.—Manœuvring gas valve

in which the wires are encased. Provision is made in the control car for operating all the gas valves (six in number) either simultaneously, singly, or in any desired combination. This is effected by a series of small cone clutches which can readily be thrown in or out of gear. Telegraph communication is provided from the control car to all the other cars. The instruments are of the non-reply type, and have large luminous dials. One turn of the handle gives an order and rings the bell of both the transmitting and receiving instruments. Speaking tubes are also arranged between the control car and the officers' quarters in the keel, attention being attracted by means of gongs at both ends of each tube.

The power plant consists of four Wolseley-Maybach engines, each developing a maximum of 230 brake horse-power at 1,400 r.p.m. These engines, it may be added, have proved eminently suitable for airship work on account of their reliability and low fuel consumption. As previously mentioned, there are two engines arranged *en échelon* in the forward car and driving a single propeller through spur reduction gear, without a reverse. The drive from each engine is taken through a plate clutch, and through shafting to the reduction gearbox at the aft end of the car, where a spur pinion on each pinion-shaft drives a spur wheel on a the required amount of surface projects outside the car. The water pipes connected to the radiators, and shown in Fig. 23, are of flexible armoured hose. A thermometer is fitted to indicate the temperature on the hot water side.

The exhaust silencers which are shown in the plan Fig. 12 are of the air-cooled type, consisting of an inner pipe, through which the exhaust gases flow, and an outer casing, separated by longitudinal fins. Air is drawn through the annular space, in which the fins are situated, by the injector action of the exhaust gases, and by the forward motion of the ship. The exhaust manifold on the engine, and a portion of the pipe leading therefrom, are water-jacketed, to obviate risk of fire.

The clutches are of the grooved multiple disc type driven from the flywheel by a form of universal joint, consisting of a number of brass-faced leather blocks, and supported at the aft end by a ball bearing mounted in a casing secured to the structure. Pressure is applied to the discs by a central spring, which may be compressed by means of a lever actuating eccentrics, thus allowing the clutch to slip when required. A clutch stop is fitted to facilitate engagement of the gearbox dog clutches. The gearbox in the forward car, which takes the power of two engines, is of the ordinary spur gear type, with a reduction ratio of 17 : 45. The thrust

block in this case is a separate unit, consisting of a double ball thrust bearing and a roller bearing mounted in a housing carried at the aft end of the structure. The forward end of the propeller shaft is steadied by the gearbox. The diameter of the two-bladed propeller on the forward car is 20 ft., and it runs at 530 r.p.m., whilst the wing car propellers, which are also two-bladed, are each 10 ft. 6 ins. in diameter, and run at the same speed as the engines, 1,400 r.p.m.; on the reverse, they run at two-thirds the engine speed.

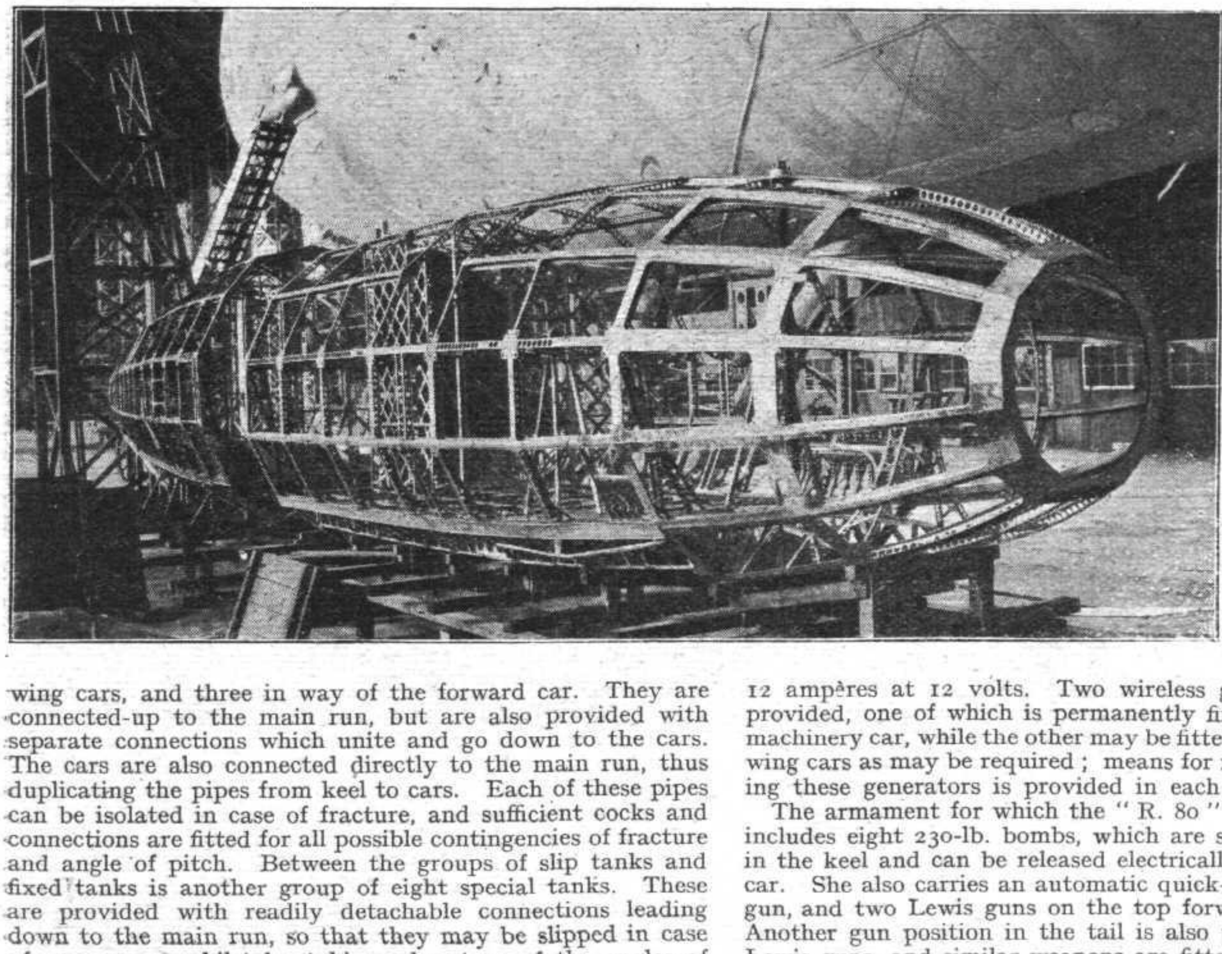
The petrol is stored mainly in the keel corridor in vertical tanks, some of which are shown in Fig. 21, and were referred to previously. Their general arrangement is indicated in Fig. 3, which should be examined in connection with the following description. These tanks, each of which has a capacity of 92 gallons when 95 per cent. full, are slung from the box girder, and steadied by kingposted girders. There are 34 tanks in all, giving a total capacity of 3,128 gallons, which, at a specific gravity of 0·725, weighs 22,650 lb., or about 10 tons. Seventeen tanks may be readily slipped overboard to act as ballast. These slip-tanks have no bottom connections, and petrol is drawn from them by means of a semi-rotary pump with a suction pipe inside the tanks. The pump discharges into the main run, as the petrol pipe, which runs from end to end of the system, is called, the foot valves of certain other tanks being opened at the same time so that the petrol can ascend into them. The fixed tanks, which act as service tanks and are kept filled from the other tanks, are situated in the corridor in the vicinity of the cars, and are placed fore and aft of the cars so as to allow for all angles of pitch. There are six fixed tanks in way of the wing cars, and three in way of the forward car. They are connected-up to the main run, but are also provided with separate connections which unite and go down to the cars. The cars are also connected directly to the main run, thus duplicating the pipes from keel to cars. Each of these pipes can be isolated in case of fracture, and sufficient cocks and connections are fitted for all possible contingencies of fracture and angle of pitch. Between the groups of slip tanks and fixed tanks is another group of eight special tanks. These are provided with readily detachable connections leading down to the main run, so that they may be slipped in case of emergency, whilst by taking advantage of the angles of inclination of the ship, the fixed tanks may be filled from them without using the hand pump. These tanks are not connected directly to the cars owing to the fact that they are at a considerable distance from the cars in a longitudinal direction. Excessive pressures might, therefore, occur in certain circumstances, and for the same reason it is considered inadvisable to feed the cars directly from the main run. All tanks are fitted with a screwed-on cap having a short filter tube, for filling by means of a hose, and also used, in the case of the slip tanks, for inserting the pump suction pipe. The fixed tanks only are provided with depth gauges of the float, cord and dial type, made by Messrs. Dewrance. Oil is carried in rectangular reserve tanks in the cars—one tank for each engine. These tanks are heated by a branch from the engine water-cooling system, and the capacity of each tank, when 95 per cent. full, is 53 gallons. The weight of oil per tank at specific gravity of 0·962, which is the figure for castor oil, is 510 lb. The total weight of oil carried in the reserve tanks is 2,040 lb., and, in addition, there is a small amount in the various service tanks.

Water ballast is controlled by means of a wire which runs from the navigating car to each water-bag, and operates a valve. The water ballast is divided into two sections, arranged as shown in Fig. 3, one being for emergency use, and consisting of four bags forward and four bags aft, while the other is used for ordinary manœuvring. The whole contents of an emergency bag are discharged when the valve is operated once, whereas any desired amount may be allowed to flow out of the manœuvring ballast bags at will. The total weight of the emergency water ballast is 4,000 lb., the total being equally divided between the fore and aft bags, while the four manœuvring bags are capable of holding 2,200 lb. In order to discharge the emergency ballast it is necessary for the operator to break a paper diaphragm in order to reach the lever. This affords a safe indication as to which bags are available for use at a moment's notice.

Separate quarters, the position of which is indicated in Fig. 3, are provided in the keel for the accommodation of the officers and men who are not on watch. The cabins are provided with tables, chairs, etc., for taking meals, and sleeping accommodation is provided in the form of hammock-bunks built into the keel structure. Food is cooked by means of special cookers heated by the exhaust gases from the engines. There are three lighting dynamos, one in each of the three cars, which are driven by roller chains from forward extensions of the crankshafts. Each dynamo has an output of about 12 ampères at 12 volts. Two wireless generators are also provided, one of which is permanently fixed in the forward machinery car, while the other may be fitted up in either of the wing cars as may be required; means for mounting and driving these generators is provided in each of the cars.

The armament for which the "R. 80" has been designed includes eight 230-lb. bombs, which are stowed horizontally in the keel and can be released electrically from the control car. She also carries an automatic quick-firing two-pounder gun, and two Lewis guns on the top forward gun platform. Another gun position in the tail is also provided with two Lewis guns, and similar weapons are fitted in the cars—one on each side of the forward car, and one in each of the wing cars.

Mooring and trail ropes are stowed at the forward end of the ship, and are released through trapdoors operated from the control car. In addition to the usual mooring tackle and handling lines, the special ball and gear required for use with the builder's improved type of mooring mast will also be carried. This arrangement greatly augments the serviceability of the ship by enabling it to be safely moored in the open. In the ordinary way it is the difficulty of getting the large airship into and out of its shed in rough weather that restricts its usefulness, and not the effect of the weather on the ship in the air. The man-power required to handle a rigid airship on the ground by the usual method is also out of all proportion to the object attained, as even under the calmest conditions, a body of upwards of 300 men—



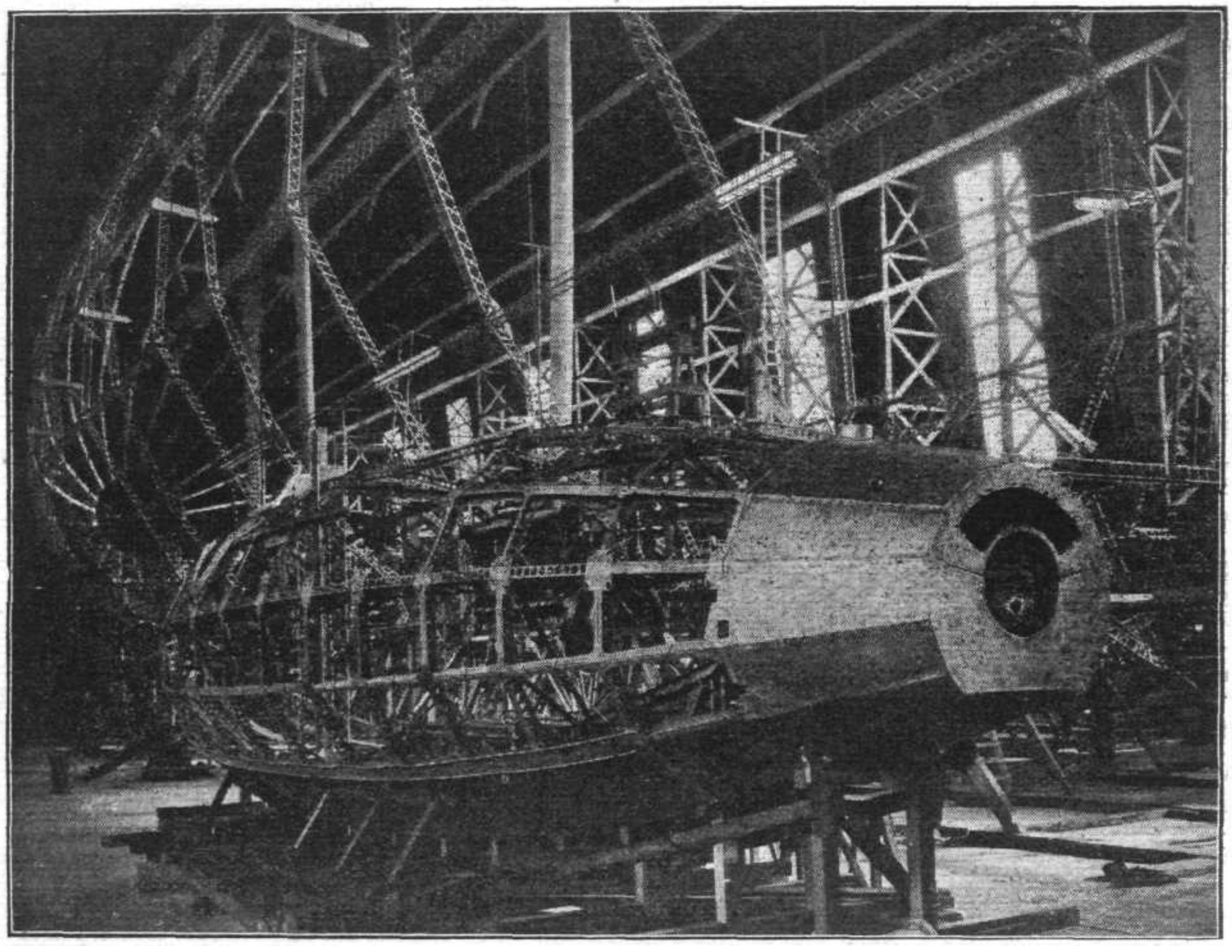
The "R.80."—Fig. 26: Framework of forward control and machinery car

according to the size of airship—must be kept standing by whenever a flight or landing is expected to take place. The problem of landing and mooring a rigid airship by mechanical means is one which has, therefore, engaged the attention of aircraft designers for some years past, although but little success attended the earlier efforts. Messrs. Vickers' mast mooring gear, however, renders the flight and landing of rigid airships independent of the weather conditions, and necessitates the employment of only such men (about ten in number) as are required to operate the mechanical devices employed. In principle, the gear consists of a tall steel mast, or tower, of such a height that, when the airship is attached by the nose to the mast, she rides on an even keel at a height of upwards of 100 ft. above the ground. The top portion of the masthead, to which the vessel is attached, is arranged to rotate, so that the ship, when moored, may always lie head on to the wind. A mooring mast of this type, suitable for rigid airships, was made by Messrs. Vickers, erected at the Pulham Airship Station, and used for a comprehensive series of mooring tests carried out with "R. 24," one of the early British rigid airships of the "R. 23" class. In the improved design of mooring tower, intended for use with passenger-carrying airships, a lift has been provided to facilitate the embarkation of passengers, who pass from the top of the tower through a flexible corridor into the nose end of the ship, from which a passage-way leads into the passengers' quarters. Connections are also provided from pipes led up the tower to corresponding pipes in the airship, to enable gas, fuel and water ballast to be pumped up to the ship whilst moored. This system of mooring appears to offer important advantages for commercial airships, as the latter can be moored to the tower in any wind the speed of which is less than that of the ship, by employimg only a few men.

Having now completed our description of the "R. 80," it may be interesting to call attention to some of the special features of the design, and to compare them with the earlier airship, "R. 33." One important point is the improvements made in the hull joints and girders which enable the string netting employed on "R. 33" and other ships to be dispensed with. This netting is very liable to be affected by climatic conditions, and consequently requires continual adjustment to maintain it at the correct tension. Its abolition, therefore, considerably reduces the difficulty of maintenance, and at the same time effects a useful saving in weight. New methods of manufacture have also enabled the gasbags of the "R. 80" to be made lighter and cheaper than those of the "R. 33," and also less permeable to gas. A considerable increase in aerodynamical efficiency has been obtained in the "R. 80" by improvements in the form of the cars, the head resistance of these cars having been reduced by over 60 per cent. in comparison with those of the "R. 33." The use of the fine nose of the control car as an observation station for the navigating officer is also an important feature of the design of the later ship, giving greatly improved facilities for ground work in comparison with other designs. Improvements in the structural design of the cars have also enabled the weight to be cut down to less than half those of "R 33," while the strength and rigidity have been increased. Consequently, it has been possible to provide more roomy cars, the beam of the control car being 8 ft. in "R. 80," as compared with 6 ft. in "R. 33." The special type of car buffer bag and buoyant covering used in "R. 80" enables a very large displacement to be obtained when floating on the water. This feature reduces the risk of bursting the bags to a minimum, and also enables the ship to alight on the water without damage and without partially immersing the cars. Great care has been devoted to the arrangement and installation of the controls. A special advantage is gained by running all controls up to the hull through a main access conduit, thus protecting them completely from the weather, while enabling them to be examined in safety and comfort while the vessel is in flight. The tubular engine-bearers above referred to and illustrated in Fig. 19, while giving a degree of rigidity at least equal to those of ordinary design, have the advantage of entirely eliminating the risk of accumulation of petrol fumes and oil, and also enable visual examination of the crankcase and big-end bearings to be readily carried out without disturbing the engine or its seating. Attention should finally be drawn to the improved design of sliding radiators. In the "R. 33" the gallows supporting the radiator above the car was a fixture, the head resistance of which was by no means negligible. This arrangement has been replaced in the "R. 80" by the neat internal slides shown in Figs. 19 and 23, and, as there are no externally projecting supports, the head resistance due to the radiator depends only upon the amount of surface exposed, becoming zero when the engine is stopped, so that the radiator can be completely withdrawn into the car.

From the report on the preliminary trial flight, which was carried out from Walney Island, Barrow, on July 19, we understand that the airship was taken out from its shed

The "R.80" —Fig. 27: Framework of wing engine car



in decidedly unfavourable weather conditions, the wind velocity at the time being 15 knots. The operation was, however, carried out safely by a large number of Messrs. Vickers' workmen, assisted by some seamen from H.M. submarines and some members of the Royal Air Force. The general view of the vessel reproduced in Fig. 17, which was taken soon after the ship had left the shed, clearly shows what a large amount of man-power is required for handling an airship under existing conditions. The ship left the ground and rose to a height of 3,000 ft., afterwards proceeding out to sea, where various manœuvres were carried out to test the stability and control, and to ascertain her performance generally. No attempt was made to determine the maximum speed attainable, but the speeds actually reached were regarded as quite satisfactory, as also were the stability and control. In turning, the " R. 80 " showed marked superiority over previous designs. The flight was continued for approximately two hours, after which a landing was effected safely in a wind blowing at 17 knots, and the ship was replaced in its shed without difficulty. The final speed trials will not take place for some few weeks, as the landing and mooring gear, above referred to, is now being fitted.

AIRISMS FROM THE FOUR WINDS.

PARIS has decided not to hold her next International Aeronautical Exhibition until 1921.

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THERE are others, we are glad to note, who are sitting up and taking notice of the utterly senseless stunts which it is now thought essential to elaborate for the delectation of those quaint folk who more or less " live " at " the pictures." On August 5 the following airism appeared in FLIGHT :—

" It is sad that such fearless men as Lieuts. Locklear and Elliott, the cinema aerial 'stunters,' should have passed in their checks whilst thus 'at work,' but what could have been reasonably expected from such utterly foolhardy monkey-tricks ? The pity of it is that public taste should be diagnosed by the cinema folk as requiring this outrageous sort of performance. There might be a good deal worse 'League' started, than one to systematically hiss down films recording this type of suicide."

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THE " leaderette " below upon the same subject is from the *Evening News* of August 25 :—

" FOOLISH TRICKS

" There seems to be a growing tendency abroad to use the cinema screen for the exhibition of performances whose only interest is that the 'artist' who achieves them risks his or her life in the act.

" In this country public performances involving undue risk to life are very rightly forbidden.

" A picture today shows an American trick airman balancing on his hands on a chair at the edge of a parapet 200 feet from the ground. The moral is enforced by a statement that he is the successor of a man who met his death at his perilous trade. We do not want this kind of thing in England, either in actual fact or through the record on the cinema screen. At the best it is foolish ; at the worst it involves sooner or later a useless sacrifice of life."

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AGAIN in Australia the aeroplane is to be brought into practical politics. Mr. Fihelly, the acting Premier of Queensland, is arranging that he and Mr. Theodore, in conjunction at the coming general elections, will carry out an extensive campaign tour by aeroplane. At the last New South Wales elections Mr. Holman adopted a similar course, but was badly beaten, and the Ministry lost its majority. May so live a man as Mr. Holman try again, and be more fortunate this time.

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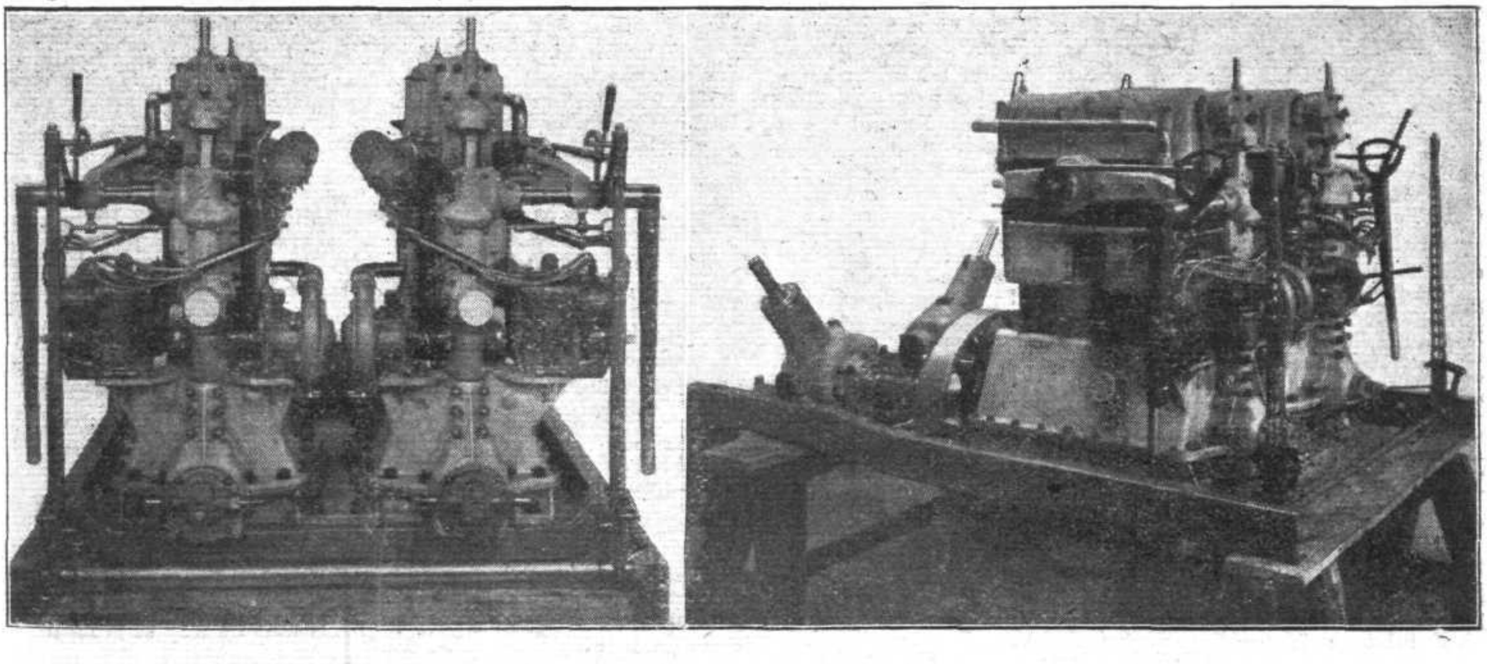
BRITISH participation in the Schneider International Seaplane Cup Race at Venice on September 19 looks like being a wash-out, as up to the present no entry has been secured on behalf of this country. Things are a bit better for the Gordon-Bennett Aviation Cup at Etampes on September 28, as three



Two views of the F.I.A.T. airship power unit. It consists of two 4-cyl. vertical engines placed side by side in a channel-section frame. The cylinders are cast *en bloc*, with enclosed overhead valves, and have a bore and stroke of 110 mm. and 190 mm. respectively. An enclosed vertical shaft drives the overhead camshaft through bevel gearing. The starting lever is also mounted on this shaft, which also drives the water pump and magneto. Each engine is fitted with a light flywheel and spring clutch, and from the latter the drive is taken to the propellers through bevel gearing and an inclined shaft from each engine

competitors are down for a try to lift the trophy. All three are live entries, and we only hope there will not be an absentee at the crossing of the line.

WITHOUT wishing to unduly criticise the wisdom of the decision of the Allies in insisting upon the *destruction* of vast quantities of enemy war material, much of which, although created for aggressive purposes, has still a high potential value for peaceful application, we cannot help thinking that there should be reasonable exceptions to the wholesale scrapping of useful items which have absorbed so much human time and energy in the dark days of the War. There is little that excites our sympathy with the instigators of the great conflict, but we must confess that a fairly good reasoning appears to be behind the workers at Kiel in the demand for a halt in needlessly smashing-up motors capable of adaptation for after-War industrial purposes. It is a case rather, we think, for handing over to one of the Allies or otherwise. In this connection, according to the *Zwoelf Uhr Blatt*, the Workers' Council (Betrieberat) of the Imperial Dockyards at Kiel has issued a manifesto to the men stating that the Entente demands the destruction of the 230 aeroplane motors which are still in the dockyards, and that each motor represents today the value of many thousands of marks. "The entire Workers' Council," adds the manifesto, "appeals to you not to bear a hand in this act of capitalistic insanity. We are prepared to destroy instruments of murder, but in the present case every guarantee has been given that the motors would only be used for purposes of civilisation. The Workers' Council expects you to display complete solidarity, and refuse compliance with any orders to destroy the motors."

"WARNING is issued by the Air Council to pilots flying between London and Paris and over Northern France that the burning of cordite is taking place at Dannes, five miles north of Etaples France (latitude 50° 36′ 0″ N.; longitude 1° 37′ 0″ E.). Owing to the resultant air pockets set up, aircraft should avoid the neighbourhood. A further notice will be issued when the operations have ceased."

It is gratifying to note that there is such a thoughtful Angel sitting up "aloft," in the form of our authorities, watching over the welfare of users of the air ocean. It is these little but highly important items which all make for "Safety First" in the air.

"AN unexploded anti-aircraft shell was unearthed by a worker on the Norbury Housing Estate of the Croydon Corporation." Evidently infected with the "ca' canny" microbe.

ALTHOUGH there probably are not many left just now who derive much income from aviation, it may be worth noting that a really valuable, concise and clear "tabular view" of the Income Tax octopus from 1842 to 1921 is now available at the modest cost of one shilling. Published by Oliver and Boyd, of 33, Paternoster Row, this compilation is the most practical summary of the Income Tax payer's troubles we have ever seen. In fact it sets out the whole business in such clear form that for the first time we have, personally, been able to follow the ramifications of this ghastly life-sucking parasite of civilisation. Its study may well repay those even with the most modest income. By way of instance, we handed our copy over to a friend for five minutes whilst he was waiting. By the end of that time he returned it with thanks, saying he believed from it he had discovered a possible rebate to which he was entitled for past years. Later we learnt that he had—amounting to several hundred pounds! *Verb. sap.!*

Air Work in Mesopotamia

THE following was issued by the War Office on August 26: "The situation in Mesopotamia, according to reports dated the 24th, continues quiet. Aeroplane reconnaissance on the Lower Euphrates reported no hostile movement. . . . Our aeroplanes inflicted over eighty casualties on a hostile concentration near Bakuba. Many of the tribesmen in this area are returning to their homes."

It was stated by the War Office on August 28 that "the situation on the Shatt-el-Hai (which runs from Kut to the Euphrates) is reported critical, and the Political Officer at Shathreh (35 miles north of Nasiriyeh) is being withdrawn by aeroplane to Nasiriyeh."

An Air Raid in Persia

ON August 26, reports *The Times* correspondent at Teheran, British aeroplanes from Kasvin, after several days of enforced inactivity owing to cloudy weather, made a successful bomb raid on Enzeli Harbour, two direct hits on oil boats being observed. It was observed that the shipping in the harbour had increased, but whether the Azerbaijan Republic was determined to continue reinforcing or was endeavouring to evacuate the troops and stores was not clear.

An Attack on Raisuli

THE natives report that Raisuli's stronghold at Tazeraut, in the Beni Aros mountains, was bombarded by Spanish aeroplanes during the early part of last week, reports *The Times* Tangier correspondent. They state that a few houses in the village were destroyed, a few villagers wounded, and some of Raisuli's horses and mules killed.

One bomb fell in a small garden in which Raisuli was seated, but did not explode. Further bombardments are reported later in the week, but no details have been received.

"R.32" over London

COMPARATIVELY few Londoners saw the "R.32" on August 27, when she paid a surprise visit in the course of a 24-hour trip by way of training for the American crew who are to take over the "R.38." The "R.32," which had started from in Yorkshire, cruised over London from a south-easterly direction, and after circling above the Crystal Palace returned the same way.

A Fatality in Ireland

WHILE an aeroplane piloted by Lieut. Norman B. Dimmocks, R.A.F., was flying over the aerodrome at Castlebar on August 28, it crashed, and Major H. F. Chads, M.C., 2nd Border Regiment, who was a passenger, was killed, and Lieut. Dimmocks was badly injured.

Sinn Feiners and Stranded Machine

FROM a report to hand from Cork it seems that the Sinn Feiners can at least claim to have been responsible for the destruction of a British aeroplane. It appears that owing to engine trouble the machine had to descend between Fermoy and Lismore. The officer in charge was about to proceed to Ballyduff telegraph office to summon assistance from Fermoy, when he and the pilot were attacked by disguised men, to whom they had to surrender, the aeroplane being set on fire.

The Zeppelin Hangars at Tondern

FROM Berlin it is reported that the members of the Demobilisation Committee, after their recent inspection of the Zeppelin hangars at Tondern, fixed the price for them at 23 million marks. Denmark has been asked if she would like to take them, and in the event of the reply being in the negative, they will be dismantled and brought to England.

A Trans-Canada Race

A PROPOSAL has been made by the Canadian Air Board for a flight from Halifax to Vancouver, a distance of 2,800 miles. Half the distance is to be covered by aeroplane and half by seaplane. It is proposed that the flight should be carried out toward the end of September.

More Aeroplanes for Poland?

ACCORDING to the Polish Information Bureau, a telegram from Warsaw, dated August 23, says that Sir Reginald Tower has informed the State Council of Danzig that eight railway cars, containing aeroplanes for Poland, *en route* for Poland, have been detained in Danzig. The Burgomaster, Dr. Sahm, proposed to the Assembly to reply to the High Commissioner to the effect that, in view of Danzig's neutrality, the State Council would not intervene.

Mdlle. Bolland Crosses the Channel

AT her third attempt, on August 25, Mdlle. Bolland succeeded in flying across the Channel on her Caudron, but owing to engine trouble had to land at Westenhanger. She started from Le Crotoy and intended to fly to Croydon.

Paris to Constantinople

STARTING from Paris one day last week, a Farman Goliath, after a flight of 15 hours, landed at Bejania, on the Save, close to Belgrade. Continuing its flight, it flew by way of Sofia to Constantinople.

Monoplane Stolen from Pau

SOME consternation was caused at the Pau aerodrome in the south of France last week, when a Morane-Parasol monoplane disappeared. It is alleged that it was flown off by a British pilot, who landed it at San Sebastian in Spain. The French consul seized the machine, and telegraphed for a pilot to fly it back to Pau. There is no news as to what happened to the pilot who took it to San Sebastian.

AEROPLANE PERFORMANCES AS INFLUENCED BY THE USE OF A SUPERCHARGED ENGINE *

By GEORGE DE BOTHEZAT, Aerodynamical Expert, National Advisory Committee for Aeronautics

THE question of the influence of the use of a supercharged engine on aeroplane performance will be treated here in a first approximation, but one which gives an exact idea of the advantage of supercharging. The method used may be directly extended to treat this problem without any of the simplifying assumptions made. These assumptions are made exclusively to allow an easier survey of the problem.

Let us consider an aeroplane which climbs first with an ordinary engine, not supercharged (called in the following case I), and afterwards climbs with a supercharged engine (case II), and let us find the difference of the ceilings reached in the two cases.

We will asume in both cases the power a_{m_0} of the motor at sea level to be the same and the efficiency η of the propeller to be maintained constant all the time. This is quite possible, to a certain extent for a propeller with an adjustable pitch, a conclusion reached by theory and experimentally verified.

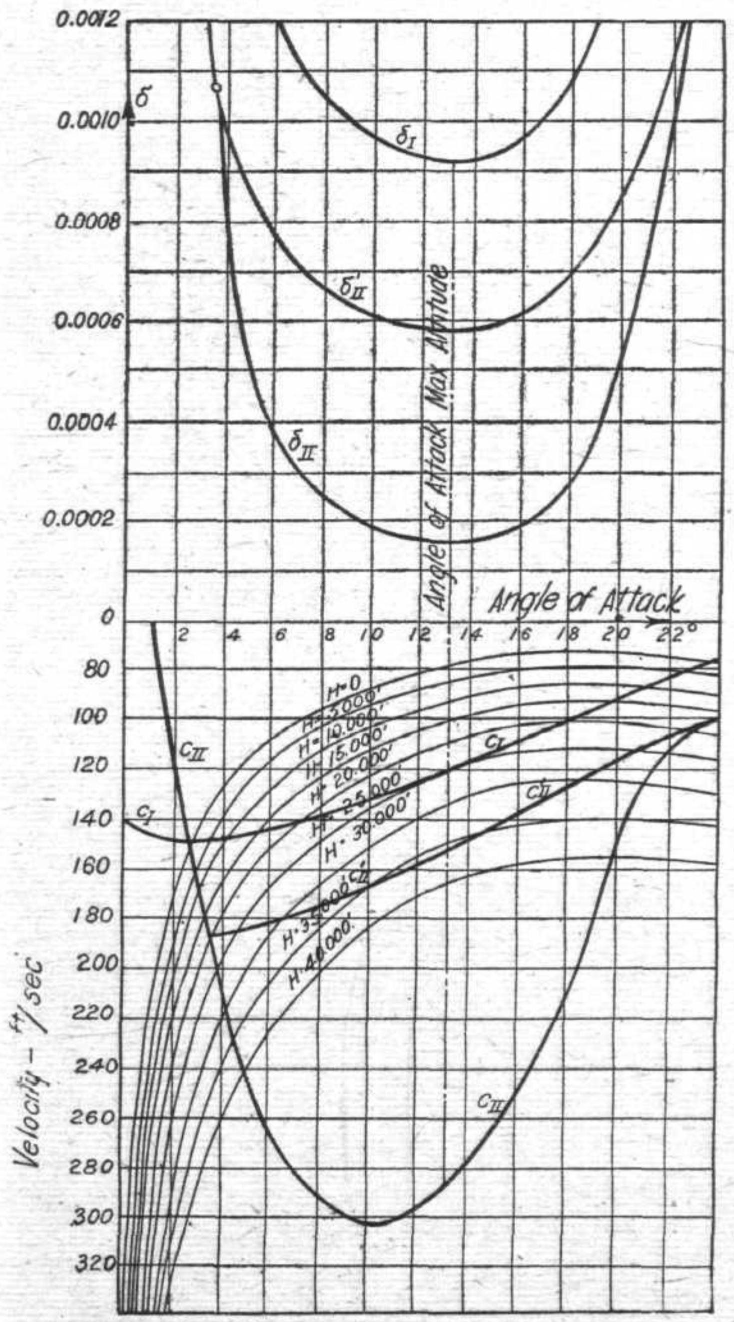
In case I, we can consider in a first approximation the power a_m of the motor to be proportional to the density, that is, to be expressed in the form

$$a_m = m\delta \tag{1}$$

where δ is the air density at a given height, H.

m a constant coefficient characteristic for the motor considered, assuming the number of revolutions of the motor to be kept nearly constant.

* Technical Notes: U.S. National Advisory Committee for Aeronautics.



At sea level we have

$$a_{m_0} = m\delta_0 \tag{2}$$

where δ_0 is the corresponding air density.

The power expended for horizontal flight at any altitude is equal to

$$a_n = \eta a_m = \eta m\delta = QV \tag{3}$$

where η is the propeller efficiency, Q the propeller thrust, V the flying speed. On the other hand, the equations of the horizontal steady motion are of the form

$$P = R_y = k_y\,\delta AV^2 \tag{4}$$

$$Q = R_x = k_x\,\delta AV^2 \tag{5}$$

where P is the total weight of the aeroplane, k_x and k_y the drag and lift coefficients (functions of the angle of attack only), A the wing area. Comparing (3) and (5), we find

$$QV = \eta m\delta = k_x\,\delta AV^3 \tag{6}$$

and following

$$\frac{\eta m}{A} = k_x V^3 \tag{7}$$

an equation that fixes the relation between the angle of attack i and the speed V for horizontal flight at any altitude in case I. I call *climbing curve* (*or C curve*) the curve of V plotted against i according to equation (7).

Let us now plot on a system of (V, i) axes the system of curves (*see* equation (4)).

$$\frac{P}{\delta A} = k_y V^2 \tag{8}$$

for different values of δ. I call the last curves *velocity curves* (*see* figure). As the height H reached by an aeroplane is a direct function of δ (depending upon atmospheric conditions) for the curve (8), we can use H as parameter instead of δ. If we plot on the same (V, i) axes the **C** curve (7), each point of intersection of a velocity curve with the C curve gives for the height H corresponding to the velocity curve considered, the velocity V and the angle of attack i of the horizontal flight at the height H of the aeroplane considered. That velocity curve which is tangent to the C curve gives the value H_1 (case I) of the ceiling and the values of V and i corresponding to this ceiling.

The last value of the ceiling can also be found directly as follows: Eliminating V from (7) and (8), we find

$$\delta_1 = \frac{P\delta_0^{\frac{2}{3}}}{A^{\frac{1}{3}}\,\eta^{\frac{2}{3}}\,a_{m_0}^{\frac{2}{3}}}\left(\frac{k_x}{k_y^{\frac{3}{2}}}\right)^{\frac{2}{3}} \tag{9}$$

that is, the density δ_1 (for case I) in function of the angle of attack i. The minimum value of δ_1 given by the last equation will correspond to the maximum of the height H, that is, to the ceiling. Thus the value i_M of the angle of attack corresponding to the ceiling in case I will be found from the relation

$$\frac{d\,(\delta_1)}{di} = D \text{ or } \frac{d}{di}\left(\frac{k_x}{k_y^{\frac{3}{2}}}\right) = D$$

and

$$\delta_{1_{min}} = \delta_1\,(i_M) \tag{10}$$

Practically, the best way is to plot the curve (9) and find its minimum graphically, because k_x and k_y are empirical functions.

It is easy to see that the angle of attach i_M, for which δ_1 is minimum, is the same angle for which the power a_n expended for flight at sea level is minimum. In fact we have

$$a_n = QV = k_x\,\delta_0\,AV^3 \tag{11}$$

and replacing in the last equation V by its value taken from (8) we get

$$a_n = \frac{P^{\frac{3}{2}}}{A^{\frac{1}{2}}\,\delta_0^{\frac{1}{2}}}\;\frac{k_x}{k_y^{\frac{3}{2}}} \tag{12}$$

The minimum of a_n takes place for an angle of attack given by

$$\frac{d\,(a_n)}{di} = D$$

that is

$$\frac{d}{di}\left(\frac{k_x}{k_y^{\frac{3}{2}}}\right) = D$$

which thus is the same angle i_M.

On the annexed figure are represented the velocity curves and the C_1 curve for a good actual aeroplane, as well as the δ_1 curve for case I, which curves fully illustrate all the foregoing. The ceiling is reached at an angle of attack of 13°, at a speed of 120 ft./sec., and has a value of 25,000 ft.

In case II we will have the power a_{m_0} maintained constant by the supercharger, up to a certain altitude, say 20,000 ft., for example. Afterwards the power of the motor will again

drop in a first approximation as the density. Let us first assume the limit possibility of

$$a_{m0} = Const$$

up to any altitude.

Proceeding quite similarly to case I, we will find

(13) $$a_n = \eta a_{m0} = QV = Const$$

following

(14) $$QV = \eta a_{m0} = k_x \delta A V^3$$

and dividing by (4) we get

(15) $$\frac{\eta a_{m0}}{P} = \frac{k_x}{k_y} V$$

an equation which represents the C_{II} curve in the limiting case II.

Plotting this C_{II} curve on the velocity curves, we will directly see the enormous increase of ceiling that an unlimited supercharging would give. The fact to be noted is that even in the case of an unlimited supercharging we reach a ceiling.

In this last case the density curve has for expression

(16) $$a_{II} = \frac{P^3}{A\eta^3 a^2_{m0}} \left(\frac{k_x}{k_y^{\frac{3}{2}}} \right)^2$$

and its minimum, corresponding to the ceiling, takes place for the same angle of attack i_M as in the preceding case.

(17) $$\delta_{II\,min} = \delta_{II}\,(i_M)$$

But the supercharging maintains the power only up to a certain altitude, and after this altitude is reached the power of the motor will vary according to the law

(18) $$a_m = m_c \delta$$

where the value of m_c has to be taken from the relation

(19) $$a_{m0} = m_c \delta_c$$

δ_c being the density at the limit height up to which the supercharger maintains the power. The aeroplane will start to climb from this altitude as if δ_c were the sea level.

After the density δ_c has been reached, there must accordingly arise a sudden change in the course of the C_{II} curve. Its second branch C'_{II} will be given, as is easy to see, by the relation

(20) $$\frac{\eta m_c}{A} = k_x V^3$$

and the corresponding δ'_{II} density curve will be

(21) $$\delta'_{II} = \frac{P\delta_c^{\frac{2}{3}}}{A^{\frac{1}{3}}\,\eta^{\frac{2}{3}}\,a_{m0}^{\frac{2}{3}}} \left(\frac{k_x}{k_y^{\frac{3}{2}}} \right)^{\frac{2}{3}}$$

and its minimum takes place, as it is easy to see, for the same angle of attack i_M, which minimum fixes the value of the ceiling in this last case of supercharging,

(22) $$\delta'_{II\,min} = \delta_{II}\,(i_M)$$

The C'_{II} curve and the C_{II} curve necessarily intersect on the velocity curve

(23) $$\frac{P}{\delta_c A} = k_y V^2$$

corresponding to the value a_c of the density up to which the supercharging maintains the motor power.

In the case of our figure the ceiling from 25,000 ft. is increased to 37,000 ft., the supercharging maintaining the power only up to 20,000 ft. This makes, in comparison with case I of an engine without supercharging, an increase of the ceiling of about 50 per cent.

We thus see the whole importance of engine supercharging, which has for general result so sensible an increase of ceiling.

PERSONALS

Married

Group Capt. P. R. C. GROVES, C.B., C.M.G., D.S.O., R.A.F., eldest son of Mr. J. Groves, late P.W.D., India, and Mrs. Groves, was married on Saturday, August 28, at the British Embassy Church in Paris, to SUZANNE, daughter of Mr. T. E. STEEN and Mrs. STEEN, of Christiania, and 107, Rue de la Pompe, Paris. Marshal Foch was present at the ceremony.

E. F. "DEREK" JOHNSON, late U.S. Air Service, of Providence, U.S.A., was married on August 5 at St. Matthias' Church, Earl's Court, to DOROTHY, younger daughter of Mrs. ROSE, 29, Eardley Crescent, S.W. 5.

To be Married

The engagement is announced of Flight-Lieut. W. R. D. ACLAND, D.F.C., A.F.C., younger son of Sir Reginald and Lady Acland, Cold Ash, Newbury, Berks, and MARY STRANGE daughter of Mr. and Mrs. T. MARSHALL, Trelawny, Lee-on-the-Solent.

The marriage arranged between Flt. Lieut. CECIL GEORGE MATHEW, R.A.F., and Miss EMILY GEALE HESTER LOWRY ALEXANDER will take place quietly at All Saints' Church, Child's Hill, N.W. 3, on September 7, at 1 o'clock.

Danger Zone on French Coast

IT is hereby notified :—

Pilots flying between London and Paris and over Northern France are warned that the burning of cordite is taking place at Dannes, 5 miles north of Étaples, France (latitude 50° 36′ 0″ N., longitude 1° 37′ 0″ E.)

Owing to the resultant air pockets set up, aircraft should avoid the neighbourhood.

A further notice will be issued when the operations have ceased.

(Notice to Airmen No. 91.)

Italy Gets a Zeppelin.

THE Germans have now delivered a Zeppelin—the "L.61"—to Italy. The airship in the course of her voyage from Friedrichshafen negotiated the Alps without any difficulty.

From Holland to the Indies

THE Vice-President of the Council of the Dutch East Indies recently received Capt. Leendertz, and, after hearing details regarding his proposed flight from Holland to the East Indies, promised that the Government would render all possible aid. Capt. Leendertz proposes to use a Bristol machine, which can take 15 passengers.

A Berlin-Amsterdam Service

A NEW aerial service between Berlin and Amsterdam *via* Bremen was to have started on Tuesday. The machines will run three times a week and carry all classes of mail matter. There will be a connection with the service to London at Amsterdam.

Spain to Buy British Machines

A DECREE, published in Spain, authorises the Spanish Minister of War to purchase some new machines of the De Havilland type.

New Aerodromes in Spain

THE Spanish Minister of Public Works has authorised the laying out of an aerodrome at Lacarte, close to San Sebastian, while another is to be established near Bilbao and the Archanda mountains.

Greeks Bag an Aeroplane

IN the *communiqué* received in London from the Greek Headquarters at Smyrna, dealing with operations on August 29 about 50 miles S.E. of Philadelphia, it is recorded that one enemy aeroplane was brought down.

Double Fatality in Sweden

WHILE flying an Army Albatros aeroplane two Swedish airmen crashed at the Revinge Flying Ground, South Sweden, on August 25, and both were killed.

Repatriation of Anzacs

FOUR aeroplanes, carrying £500,000 collected for the Peace Loan, were engaged in the first Australian Aerial Derby, reported *The Times* Melbourne correspondent on August 28. The distance, 116 miles, from beyond Bendigo to Melbourne, was covered in 1¼ hours. Only 2¼ minutes separated the first and last machines.

Mr. Millen, the Minister of Repatriation, who acted as judge, in a speech of congratulation, said that the whole of the Peace Loan, £25,000,000, would be spent on repatriation.

Lieut. Parer's Final Misfortune

AFTER doggedly pursuing their way across Australia towards Melbourne, Lieuts. Parer and McIntosh finally met with disaster near Culcairn, not far from Bathurst, and about 200 miles from Melbourne. The wings, tail and propeller of the machine were broken. Another machine may be provided to enable the aviators to complete their journey by air. The Federal Government are to give an official welcome to the airmen, Lieuts. Parer and McIntosh, on their arrival in Melbourne, and to present them with £500 each.

New York–Alaska Flight

THE four De H. machines, which set out from New York on July 15 to fly by stages to Nome, Alaska, successfully completed their journey on August 26.

CORRESPONDENCE

[The Editor does not hold himself responsible for opinions expressed by correspondents. The names and addresses of the writers not necessarily for publication, must in all cases accompany letters intended for insertion in these columns.]

THE ANGLE OF CLIMB

[2027] I should like to draw attention to what is an apparent anomaly in the measurement of aeroplane performance, in that climb is recorded by the time taken to reach a given height, whilst the exact opposite, *i.e.*, rate of descent, is given by the angle the flight path of the aeroplane makes with the horizontal. This latter, it is hardly necessary to state, is known as the gliding angle, and my suggestion is that climb should be recorded in the same manner, as well as by the hitherto orthodox one giving the rate of ascent in ft. per min.

It may not, at first, be apparent what purpose would be served by recording the *angle* of climb, till it is remembered that a fast machine climbing at 1,000 ft. per min. has traversed a much greater distance over the earth by the time this height is attained than a really slow machine climbing at only 500 ft. per min., which shows that a slow-climbing machine may nevertheless possess a superior climbing angle. Ten years or so ago, the speed of the fastest and slowest aeroplane was not separated by the gap which exists today, and figures for climb in ft. per min. provided sufficient data for comparison of performance. The time taken to reach a given height is, of course, important, but is not the angle of climb at least equally important ?—especially so today when efforts are being made to develop the aeroplane in the direction of commercial utility, where the ability to rise safely from restricted aerodromes will prove a greater asset than sheer speed rivalling that of the meteorite and manœuvrability comparable with that of the dragon-fly. The commencement of the climb is the vital part in this case, and if the climbing angle were measured from the point where the machine accelerated from rest up to, say, a height of 500 ft., data for the accurate comparison of the abilities of different machines to ascend safely from restricted aerodromes would then be available. R. F. MANN

MAKING AIRWAYS PAY

[2028] I was much interested in your "Editorial Comment" on the views expressed by Mr. Searle through the medium of *The Times* under dates August 13, 14 and 16. Some of his ideas may, as you say, "seem a little revolutionary," but coming as they do from an acknowledged transport authority, they are well worthy of closer examination. It is true that war practice made for speed, strength and efficiency at any cost, but most if not all war practice must be gradually scrapped if commercial aviation is to progress.

I agree with Mr. Searle's views regarding the use of wooden wings in preference to metal, if only for the reason that metal—such as is used today in aircraft practice—is not *durable*. And if we are to look forward, as we must, to carrying a much greater loading per sq. ft., then metal must at this stage be ruled out.

Wood, as a material, is widely understood, easily manipulated, and constant in its structure in all the different species, and if used in cantilever wing construction together with a ply-wood surface or system of planking, forming, with the interior construction, the flanges of a girder or girders, is, I submit, preferable to the use of metal alloys.

Mr. Searle favours the monoplane form of construction, which, if fitted with a cantilever wing, is capable of carrying greater loads than the ordinary sparred plane with its strutting and bracing; then there is no advantage in superposing one or more such wings.

The monoplane of the past with its weaknesses should be ruled out, but one cannot help thinking that Mr. Searle had concrete ideas of existing practice in the direction of monoplane construction, and perhaps had in mind the cargo-carrying machine fitted with the "Alula" wing which was referred to in FLIGHT on July 22. The wind-tunnel tests of this wing, together with the illustrations, give me the idea that with comparatively low cruising speeds much would be achieved.

Regarding the question of safety and suitability of the monoplane wing construction for commercial services, you say, Sir, that "safety is once more the paramount factor in commercial aviation," but if the wing is of special and particular design and construction (eliminating strutting, bracing, etc.), a plan shape, with proper application of scientific knowledge, will be produced. From the illustrations on page 814, it is apparent that a wing, which has proved marked superiority on test, can be very well built entirely of wood, embodying cantilever construction.

Mr. Searle's ideas of "containers" that would facilitate the packing and transference of goods is commendable, and in the question of a conference to decide upon a form or forms of standardisation, it should be rather that the containers are standardised and not the general size or design of machines.

Though much might be done by means of such a conference, care must be taken that innovations that are of real utility should not be hampered. ARTHUR H. BAILY, *B.Sc., A.M.I.C.E.*

FLYING LAWS AND OTHER MATTERS

[2029] The Laws governing Civilian Flying are on the whole very far sighted and sound, but there are one or two exceptions which are at least worthy of discussion. By criticism alone can perfection be attained.

Naturally it is necessary for the civilian pilot carrying passengers to be subjected to stricter laws now than was the case when he was a member of the Royal Air Force. This is justifiable in order to ensure the utmost safety for the passengers. However, there is one rule that a pilot is expected to observe which, though advanced in the name of safety, in many cases defeats its own object, thereby becoming a source of danger. I refer to the objections that are met with on civilian aerodromes, especially those in the vicinity of towns, to the execution of gentle turns when flying near the ground or "taking off," and also to "side-slipping," when landing. The latter I have seen discussed at length before in your columns. It is with the former that I am concerned, that is to say gentle turns when near the ground. Naturally, steep climbing or zooming turns are a different matter altogether. Also I refer to the average machine used for passenger carrying, and not to the types that creep off the ground after a quarter mile run, and are seen ten minutes later five miles away just clearing a 400 ft. hill.

From the very commencement of flying one of the most frequent causes of crashes has been due to engine failure occurring when a machine is taking off towards hangars or other buildings. These conditions being frequently met with on all aerodromes, particularly those in close proximity to buildings.

Now the danger is due to the fact that, when "taking-off" over buildings there is always a period, sometimes but a few seconds, when, should the engine fail, either the machine must crash into the obstacle ahead, or else the pilot must make a complete 180° turn on the glide and then land down wind. When it is considered that the machine is probably at the most 200 ft. from the ground, when this crisis arises, it will not be difficult to understand the danger of attempting this manœuvre. Indeed it is an axiom of nearly all pilots that turning back and landing down wind when only just off the ground is a source of danger to be avoided as one used to avoid A.P.M.'s. Should the engine cut out before the machine has reached this particular position the pilot will have sufficient space between his machine and the obstacle ahead to turn at right angles and to land across wind and parallel to the obstacles. While should it stop after the dangerous period I have just described, the machine can clear the obstacle and land on the further side. But between these two positions there is a very dangerous period. If the following manœuvre is employed it will be seen that it is absolutely unnecessary to incur this danger.

When taking off towards an obstacle, shortly after the machine has left the ground and when sufficient speed has been attained to render a gentle turn feasible, the pilot turns the machine through 90° so that by the time the obstacle has been reached he is flying at right angles to his original direction and parallel to the obstacle. The drawing clearly shows thereby it is never necessary to make a turn of more than 90° in order to land inside the aerodrome. This turn being deliberate is simple, added to which the pilot has full confidence in his ability to land safely and easily should the emergency occur. Whereas taking off over buildings he is subjected to the fear of mechanical failure placing him suddenly in an extremely dangerous position. This theory is nearly as old as flying itself, and was very universally practised during the War. Why should it be banned now ?

Of course, there are one or two exceptions, such as the London Terminal Aerodrome, where when taking off into a light S.W. wind (the prevailing summer wind) the slope of the aerodrome is so steep that the average passenger machine can often only just attain sufficient speed to stagger over the hedge between the lighthouse and the Customs, thus rendering a turn impossible. But the Waddon Aero-

drome is a notorious exception to most rules. The Le Bourget Aerodrome, on the other hand, is a very typical example. Two out of the three sides of this landing ground are lined thickly with hangars, offices, douanes, and tall trees, while the apex touches the village itself. So that twice out of every three times when a machine takes off it must necessarily fly over some of these obstacles or else turn. I think most pilots dislike flying even for a few seconds where they cannot land.

During the War, pilots were being trained in immense numbers against time, so that their dual tuition had to be cut shorter than was to be desired. Their resultant inexperience upon commencing solo flying, and their average inability at this stage even to turn a machine with safety, called for a sweeping rule upon many aerodromes forbidding all turning under 500 ft. It was thought better to let the pupil take off straight over an obstacle, risking engine failure, than to permit him to turn when near the ground. Although the danger from the latter risk was not so great as that from the former, it was always present with the inexperienced, whereas the former occurred comparatively seldom. But the present civilian pilot is not a pupil. He is chosen from a long list of applicants, presumably for his experience and skill. Therefore it is surely unnecessary to bind him down to rules made during the War for the benefit of those under instruction, thus preventing him avoiding a danger surmountable by the aforesaid manœuvre that any but the most tenderfoot tyro can perform with complete safety.

D. SHEPPERSON.

Chelsea.

THE ROYAL AIR FORCE

London Gazette, August 24

Permanent Commissions

Flying Officer F. Keith (A.) resigns his permanent commn., and is permitted to retain his rank; Aug. 24.

Short Service Commissions

Flying Officer B. G. Bryan (T.) resigns his short service commn., and is granted rank of Flight Lieut.; Aug. 25. The following resign their short service commns., and are permitted to retain their rank:—Flying Officer W. E. Humphreys (T.), Observer Officer R. A. Brunton, M.C.; Aug. 24.

The following temp. appointment is made:—

Group Commander.—Col. J. M. Steel, and to be actg. Brigadier-General whilst so employed; April 1, 1918 (substituted for notification in *Gazette* of May 3, 1918).

Flying Branch

Flight Lieut. R. Collishaw, D.S.O., O.B.E., D.S.C., D.F.C., to be actg. Squadron Leader whilst employed as Squadron Leader (A.); from Aug. 1, 1919, to April 22, 1920 (substituted for *Gazette* July 9). Flying Officer S. N. Kinkead, D.S.O., D.S.C., D.F.C., to be actg. Flight Lieut. whilst employed as Flight Lieut. (A.); from Aug. 1, 1919, to March 31, 1920. Flying Officer G. E. Creighton is restored to active list from half-pay list; Aug. 4. Pilot Officer J. R. Astin to be Flying Officer; May 11 (since demobilised).

The following are transferred to Unemployed List.—Sec. Lieut. F. W. Young; Feb. 1, 1919. Lieut. R. R. White; April 7, 1919. Lieut. S. P. Colt; April 29, 1919. Lieut. H. C. Hawkins; Feb. 11. Lieut. A. S. Poynton; July 19. Sec. Lieut. S. G. Davies; July 29. Lieut. W. C. Egerton, Lieut. A. H. Parsons; Aug. 5. Maj. G. P. Wallace, D.S.O.; Aug. 23.

The following Sec. Lieuts. relinquish their commns.—C. H. A. Farnan (*Gazette* Oct. 14, 1919, to stand); (Hon. Lieut.) R. J. Hunt (*Gazette* Aug. 8, 1919, to stand); S. N. Jacobson (*Gazette* Feb. 14, 1919, to stand); (Hon. Capt.) I. H. Stockwood (*Gazette* May 30, 1919, to stand).

The notification in *Gazette* of June 11 concerning Lieut. H. C. Hawkins is cancelled; *Gazette* Aug. 20, 1918, concerning G. Thomson should read George Irvine Thomson.

Administrative Branch

The following relinquish their commns.—Lieut. (actg. Maj.) N. McArthur; Aug. 17 (*Gazette* March 18, 1919, to stand). Sec. Lieut. G. R. Morgan (*Gazette* April 29, 1919, to stand).

Technical Branch

Sec. Lieut. R. Locke to be Lieut; June 1, 1919.

The following Pilot Officers to be Flying Officers, Grade (A.).—A. C. Smith; Aug. 18, 1919. G. J. Stroud; Oct. 1, 1919.

The following are transfd. to Unemployed List.—Lieut. L. E. Yeomans; Jan. 18, 1919. Lieut. A. J. L. Chrystall; Sept. 1, 1919. Lieut. R. J. Finch; Oct. 15, 1919 (substituted for *Gazette* Nov. 4, 1919). Lieut. R. Locke; Dec. 23, 1919 (substituted for *Gazette* Jan. 16). Capt. D. G. Bourn; May 25. Lieut. E. D. Dawson; July 15. Lieut. G. J. Engwell; July 25. Lieut. R. W. Seldon; Aug. 5. Sec. Lieut. J. W. Brittain; Aug. 18.

Memoranda

Sec. Lieut. C. H. Finnis (S.O.) to be Lieut.; July 15, 1919.

(Then follow the names of 26 Cadets who are granted hon. commns. as Sec. Lieuts.)

P.F.O. E. A. C. Grant is granted an hon. commn. as Sec. Lieut., with effect from the date of his demobilisation.

Lieut. C. H. Finnis (S.O.) is transfd. to Unemployed List; Feb. 1 (substituted for *Gazette* March 16).

Sec. Lieut. C. W. Holden relinquishes his commn.; March 1, 1919.

London Gazette, August 27

Short-Service Commissions

The following officers are granted short service commns. in the ranks stated, with effect from the date indicated, retaining their seniority in the substantive rank last held by them prior to the grant of this commn., except where otherwise stated:—

Flight Lieut.—C. C. Clark (A.); Aug. 23.

Flying Officers.—K. S. Broughall, M.C. (A.); July 21. G. P. W. Chandler (A.); Aug. 23. A. C. Clinton (A.); Aug. 15. R. T. Colley (A. and S.); Aug. 16. F. C. B. Greene (A.); Aug. 10. A. F. Ingram (A.); Aug. 21. C. Jackson (A.); Aug. 23. A. T. S. L. de Lacroix (A.); Aug. 23. E. R. B. Playford (A. and S.); Aug. 25. A. L. Russell (A.); Aug. 23. W. M. Shoosmith (A. and S.); Aug. 23. A. F. White (A.); Aug. 23.

Flying Officers (from Pilot Officers).—With seniority of the dates indicated:—L. J. V. Bates (A.); Aug. 12. W. E. Gandell, M.M. (A.); Aug. 17. W. F. McManus (A.); Aug. 19. N. V. Moreton (A.); Aug. 18. G. E. Pratt (A.); Aug. 13. H. D. Wardle (A.); Aug. 18. Flying Officer J. F. Herd (T.) is transferred to the Reserve, Class B; Aug. 29.

The notification in *Gazette* of July 13, appointing Flight Lieut. A. Watson, M.B. (Med.), to a short service commn., is cancelled.

The name of Flying Officer Gerald Augustus Elliot (A.) is as now described, and not as in *Gazette*, Aug. 10.

Flying Branch

Lieut. R. A. Spencer to be Act. Capt. whilst empld. as Capt. (A.); from March 2, 1919, to April 30, 1919. Lieut. T. C. Traill, D.F.C., is graded for purposes of pay and allowances as Capt. whilst empld. as Capt. (A.); from May 1, 1919, to July 31, 1919. Lieut. N. F. Bardell is graded for purposes of pay and allowances as Capt. whilst empld. as Capt. (K.B.); from May 1, 1919, to July 1, 1919 (substituted for *Gazette*, June 13, 1919).

Lieut. C. D. Griffiths (Lieut. R.W. Fus.) relinquishes his temp. R.A.F. commn. on return to Army duty; Jan. 15, 1919.

Transferred to Unemployed List.—Lieut. A. MacArthur; Jan. 12, 1919. Lieut. (Act. Capt.) L. F. Beynon, Lieut. J. Tocher; Jan. 14, 1919. Lieut. A. W. Clark; Jan. 27, 1919. Lieut. A. A. Tiger; April 6, 1919. Lieut. R. S. Johnston; April 15, 1919. Sec. Lieut. H. B. M. Plater; Oct. 11, 1919. Sec. Lieut. H. G. Mayhew; May 14. Lieut. W. J. Butler, A.F.C.; May 19. Lieut. W. G. Jacks; Aug. 4. Lieut. N. T. Kennard, Lieut. S. F. Woods; Aug. 11. Sec. Lieut. C. K. G. Brown; Aug. 12. Lieut. (Act. Capt.) W. S. C. Smith; Aug. 18.

The notification in *Gazette*, Nov. 14, 1919, concerning Lieut. C. B. Bird, M.C., is cancelled.

Administrative Branch

Lieut. N. F. Bardell to be Lieut. from (K.B.), and is graded for purposes of pay and allowances as Capt. whilst empld. as Capt.; from July 2, 1919, to Dec. 20, 1919. Lieut. A. C. Cunnison is transferred to the unempld. list; Aug. 11. Lieut. J. Chatterton, M.C., relinquishes his R.A.F. commn. (notification in *Gazette*, April 8, 1919, to stand.

Technical Branch

Capt. A. E. Oxley to be Act. Maj. while empld. as Maj. (Grade B); from July 4, 1918, to April 30, 1919 (substituted for *Gazette*, July 9, 1918); Capt. A. Oxley is graded for purposes of pay and allowances as Maj. while empld. as Maj. (Grade B); from May 1, 1919, to Nov. 1, 1919.

Transferred to Unemployed List.—Lieut. J. Adam; Aug. 1, 1919 (substituted for *Gazette*, Feb. 13). Lieut. H. W. Roberts; July 1. Lieut. C. F. Blunt; Aug. 5. Lieut. W. E. French; Aug. 13. Sec. Lieut. (Act. Lieut.) H. H. Weller, M.B.E.; Aug. 22.

Sec. Lieut. (Hon. Lieut.) G. McDonald relinquishes his R.A.F. commn. on appt. to a commn. in the Army (notification in *Gazette*, March 28, 1919 to stand).

Sec. Lieut. (Hon. Capt.) R. J. Wallace relinquishes his R.A.F. commn.; Aug. 5 (notification in *Gazette*, July 11, 1919, to stand).

Medical Branch

Lieut. A. Watson, M.B., is transferred to the unempld. list; Aug. 12.

Memoranda

Lieut. L. B. Goodyer is transfd. to the unempld. list from (S.O.); Jan. 13, 1919.

DISTRIBUTION OF WAR DECORATIONS

IT is officially announced that, with a view to facilitating the more rapid distribution of War decorations, no one will be summoned to an Investiture held by the King personally unless he has been awarded a degree of an order not below that of a commander or companion, the D.S.O., or the first class of the Royal Red Cross.

Those who have been awarded other decorations will have the option of receiving them at investitures in the counties in which they reside, or of having them sent by post. The county investitures will be held by Lords Lieutenant, but effect will be given to the arrangements for the ceremony only in cases where it is found that a sufficient number of recipients desire to be present.

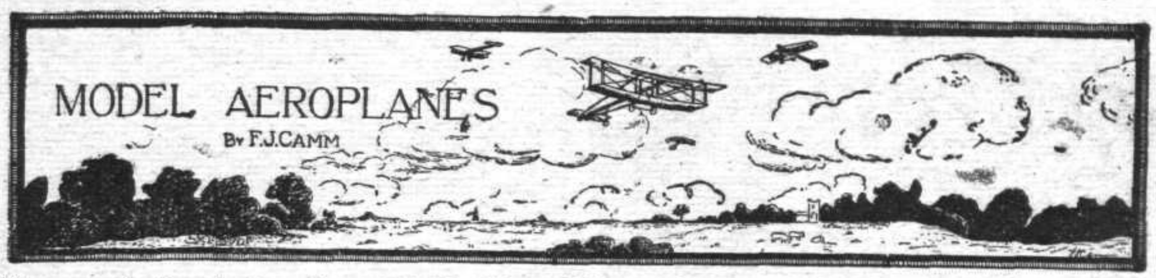
In the meantime, those who wish to attend the investitures should send to the addresses given below their full names and postal addresses (specifying the counties), together with full regimental particulars, etc.:—

Naval Awards (D.S.C.).—The Secretary, Admiralty, Whitehall, London, S.W. 1.

Military Awards (M.C. and R.R.C., second class).—The Secretary (C.2 Investitures), War Office, Whitehall, S.W. 1. (Military O.B.E. and M.B.E.).—The Secretary, Central Chancery, St. James's Palace, London, S.W. 1.

Air Force Awards (D.F.C. and A.F.C.).—The Secretary, Air Ministry, Kingsway, London, W.C. 2.

Those who prefer to receive their decorations by post should similarly communicate with the secretaries at the addresses given, stating their desire. No applications are necessary in the case of those who have been awarded the Civil O.B.E. and M.B.E.



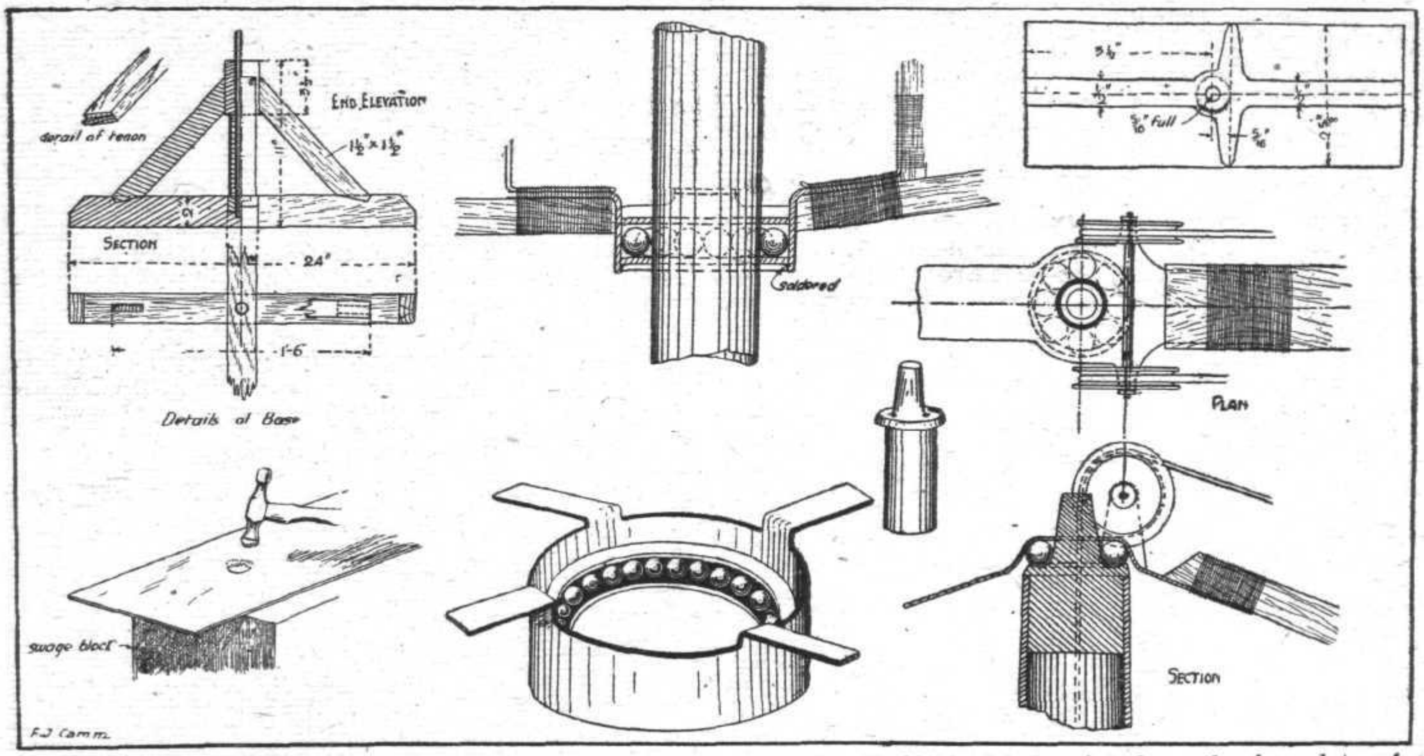
All communications to be addressed to the Model Editor. A stamp should be enclosed for a postal reply

A Whirling Arm—(*Continued*)

THE accompanying drawings show the bearings on which the whirling arm rotates about the tubular steel shaft referred to last week. These details are all reproduced fairly large for convenience in taking accurate measurements.

One of the most important tools needed to make these bearings is a lathe, and if the worker does not possess one he should try and get access to one, with permission to do his work on it himself. By so doing the whole of the bearings will cost but a trifle. The lower bearing is perhaps the best to undertake first, being rather more simple than the top one.

The first thing to do is to obtain a piece of steel cycle tubing, 1¼ in. outside diameter and 1½ in. long, No. 16 gauge. One end of this should be turned off true. Next turn up two pieces of steel plate, circular, and an accurate fit within the tube. Out of the centre of these discs turn away the area of this the ball race is to come. The cup to form the race should be made by hammering with a ball pane hammer, the point at which the cup is to be dished up being placed over a round hole in a blacksmith's swage block or other odd piece of iron, the most suitable diameter hole being ⅞-in. An old lathe face-plate, the end cf a piece of ⅞-in. iron piping, or a bit of old boiler plate bored out are amongst the makeshift things which can be used. The plate to be embossed must, of course, be heated, and the hammering done when it is red hot. For this reason perhaps the best thing to hammer on will be the end of a pipe, since it will not cool the thin plate so quickly. The process is made clear by the sketch which also shows the plate. After the boss is hammered up, the plate should be marked out and cut as shown, the parts at the four corners being cut away, leaving the central boss, with two long and two short



metal, leaving them in the form of flat rings, the internal diameter being such that they make an easy fit over the main ¾-in. tubular upright shaft. The rings are now to be pushed into the trued end of the 1¼-in. tube, and sweated with solder into place, taking care that they are true with the turned end and with each other. The distance between them should be a full $\frac{3}{16}$-in. This space between the plates will, as can be gathered from the drawing, form the lower ball race.

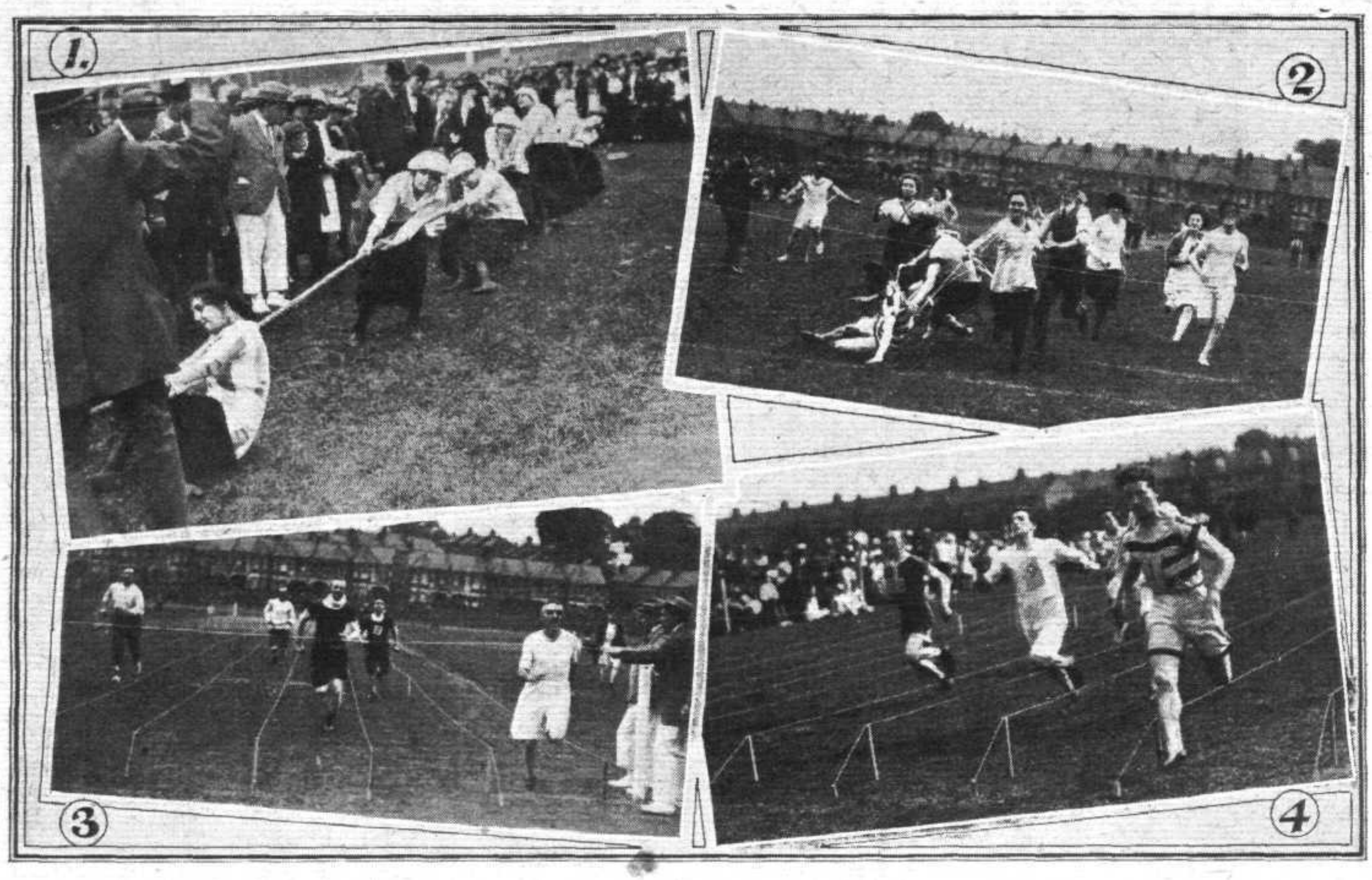
The upper part of the tube has now to be slit down with a fine hacksaw, making eight cuts. The metal between alternate cuts is then to be removed, and the bottom of the four slots thus formed filed away neatly to the four lugs shown in the illustration, which also indicates how the remaining four lugs are to be turned back to take the arms and outriggers, *c*, *d* and *g*, respectively. The insertion of a row of $\frac{3}{16}$-in. diameter steel bicycle balls completes this bearing.

The top bearing is to be made from a piece of steel rod for the fixed part, turned in the lathe to the shape shown in section in the lower drawing and in perspective in the small side sketch. It should be a tight fit in the top end of the main tubular shaft. Such bearings should properly be of either tempered steel or should be case-hardened, but in view of the small amount of wear likely to take place owing to little use, such hardening will not be really necessary.

The other part of the bearing is to be made from steel plate. A piece of about No. 17 or 18-gauge should be taken, measuring 7 ins. by 2⅝ ins. Around the exact centre of the arms. It should then be mounted on the face-plate of a lathe, and the inner side of the cup turned and polished to remove hammer marks and make a smooth race for the balls. The hole in the centre of the cup should be bored in the lathe, after the cup is formed, and the two short arms turned up to carry the spindle on which the pulleys are mounted.

The pulleys should now be made. These may be bought at the ironmonger's, but they will certainly require some attention before being used, as the average ironmonger's pulleys are generally abominably wobbley and out of truth. If you can get a pair fairly true so much the better, but they had better be put in a lathe and properly trued and balanced. The centres will require to be bushed with brass and re-drilled to fit the spindle shown in plan about $\frac{1}{16}$-in. bare in diameter, the smaller compatible with strength the better, in order to reduce friction. The diameter over the groove in which the cord runs should be ⅝-in. The spindle can very well be made from a piece of stout steel wire; a bicycle spoke will do admirably, a collar being soldered on the wire near each pulley to keep them from running toward the centre, or the spindle can be turned down from a piece of ⅛-in. steel rod, as shown in the drawing. When the spindle is ready the pulleys should be slipped on, and the lugs forming the bearings standing up from the plate should be closed over the spindle ends, and the second bearing, when the $\frac{3}{16}$-in. diameter draw balls are provided, is complete.

(*To be Continued*)



S. SMITH AND SONS' ANNUAL SPORTS ON AUGUST 28 : 1. The Grinding Shop team win the Ladies' tug-of-war ; 2. The 60 yards Blindfold Race won by Mr. Deverall and Miss Jess ; 3. 100 yards Veterans' Race, won by Mr. Crowther—the brothers Smith, on the right, give a hand with the judging ; 4. 100 yards Men's Handicap won by Applegarth in 10⅘ secs.

Artists Wanted

ARTISTS used to rapid freehand sketching of car, chassis and mechanical details are required for several weeks' work in connection with the forthcoming Olympia Motor Show. Applicants should apply to the Editor of the AUTO., 36, Great Queen Street, Kingsway, W.C. 2.

A Deal in Grass.

ALFRED CATT, a farmer, was fined £25 at Ashford, Kent, last week, for offering a gift of £50 to an officer of the land branch of the War Office in connection with the proposed purchase of grass growing on aerodrome land at Lydd.

To the Alps by 'Plane.

A TWO-ENGINED Handley Page, piloted by Lieut. Hope, which left London at 11 a.m. on Aug. 30, with four passengers and a crew of two, landed at Paris two hours later for petrol.

Several other air travellers were picked up in the French capital, and the machine went on to Switzerland, landing at the Blecherette Aerodrome, Lausanne, at 6.35 p.m.

Altogether the total distance flown was about 500 miles. The weather was not ideal, and the machine had to rise about 6,000 ft. to clear the mountains.

Army Beat the R.A.F.

IN a two days' cricket match at the Oval on Aug. 25 and 26, the Army beat the R.A.F. by an innings and 171 runs. In their first innings the R.A.F. made 123, and in the second 168. The Army made 462 and declared with four wickets in hand, Major Tudor scoring 111 and Lieut. P. V. Williams 138.

Electioneering by Air

MR. FIHELLY, the acting Premier of Queensland, is arranging, says *The Times* correspondent at Melbourne, that he and Mr. Theodore, in conjunction at the coming general elections, will carry out an extensive campaign tour by aeroplane. At the last New South Wales elections Mr. Holman adopted a similar course, but was badly beaten, and the Ministry lost its majority.

AERONAUTICAL PATENT SPECIFICATIONS

Abbreviations: cyl. = cylinder; I.C. = internal combustion; m. = motors
The numbers in brackets are those under which the Specifications will be printed and abridged, etc.

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